

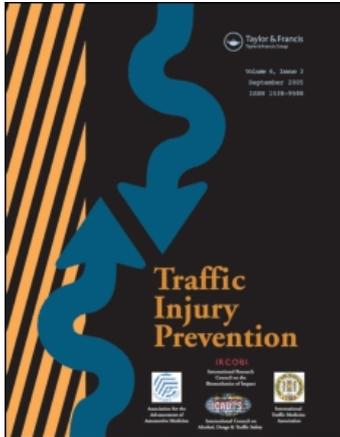
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The Effectiveness of Home-Study Driver Education Compared to Classroom Instruction: The Impact on Student Knowledge and Attitudes

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Problem: Home-study driver education programs exist in several states, but none have been scientifically evaluated to determine if such courses are as effective as classroom courses for teaching driver education.

Method: Over 1,300 students were randomly assigned to classroom instruction, or CD ROM, workbook, or Internet/workbook home-study courses and compared on proctored exit examination knowledge and attitude scores, and written knowledge test outcomes.

Results: Few differences were found on exit examination knowledge and attitude scores, but they tended to favor the CD and Internet/workbook home-study courses over the classroom or workbook courses. Differences favoring the classroom on written knowledge test outcomes likely reflect a bias in classroom courses toward teaching test-specific material.

Discussion: The findings present no compelling evidence that home-study courses are less effective than classroom courses for teaching driver education.

Impact on Industry: The findings could result in more widespread use of home-study courses. Also, the use of low-cost home-study courses as the first course of a two-stage driver education and training system could make integrating such programs with graduated driver licensing more feasible and acceptable to the public.

Keywords Driver Education; Home Study; CD; Workbook; Internet; Distance Learning; GDL

INTRODUCTION

The Safety Value of Driver Education and Training

In California, the term *driver education* refers to the part of learning to drive where facts, skills, and attitudes are taught (usually, but not always, in a classroom), and *driver training* refers to actual in-car behind-the-wheel instruction. Although driver education and training are commonly considered to have safety value for reducing teen crash and violation rates, the preponderance of research, both in California and throughout the world, does not support this view. Five international reviews of the literature have all concluded that driver education and training, even when well designed and rigorous, have not been shown to reliably reduce the crash rates of young drivers (Christie, 2001;

Mayhew & Simpson, 1996; Roberts, Kwan, & Cochrane Injuries Group Driver Education Reviewers, 2002; Vernick, Li, Ogaitis, MacKenzie, Baker, & Gielen, 1999; Woolley, 2000). However, there is evidence that formal instruction through driver education and driver training increase the knowledge and skill levels of teens (but not necessarily their safe-driving attitudes), even if these knowledge and skill gains do not translate into long-term lower crash risk (Mayhew & Simpson, 1996; Stock, Weaver, Ray, Brink, & Sadof, 1983).

Ideas for Improving Driver Education and Training

Just because driver education and training do not result in crash reductions does not necessarily mean they should be abandoned. On the contrary, traffic safety researchers recommend that they be changed to focus on the development of knowledge and skills that are more important to safety and find more effective methods for teaching the courses (Gregersen, 1996; Mayhew & Simpson, 1999, 2002). In addition to recommending

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integrating existing driver education and training with graduated driver licensing (GDL) programs, increasing the time that teens spend practicing on the road, and making driver education multi-staged with separate courses in the learner and provisional stages of licensing, it has also been recommended that driver education courses make use of emerging technology such as interactive, self-paced computer-based training (ADTSEA, 2000; Anderson, Abdalla, Goldberg, Diab, & Pomietto, 2000; Lonerio, 2001; Lonerio, Clinton, Brock, Wilde, Laurie, & Black, 1995; Mayhew & Simpson, 1996, 2002; Mayhew, Simpson, Williams, & Ferguson, 1998; McKnight & Peck, 2003; NHTSA, 1994; Robinson, 2001; Saunders, 1998).

Purpose of the Current Evaluation

Although driver education in California has typically been taught in classrooms, the California Legislature required the California Department of Motor Vehicles (DMV) to complete a study comparing the knowledge levels and attitudes of teenagers who complete driver education in a classroom course with those of teenagers who complete a home-study course. Even though there have been no recent evaluations of the effectiveness of home-study driver education for novice drivers, home-study driver education in one form or another is not uncommon. For example, California, Connecticut, Florida, Minnesota, Nevada, New Mexico, Oklahoma, Texas, and Virginia currently accept some form of home-study driver education as meeting requirements for their teen license applicants.

Given that driver education has not been shown to result in lower crash risk, one might ask why it is of interest to know whether courses taught through home-study are as effective as classroom courses for presenting the material. Regardless of the negligible safety benefits of driver education and training courses, many states still either require such courses for teens or allow them to be on the road at an earlier age if they take such courses, which is counterproductive to GDL effectiveness (Williams & Mayhew, 2003). The continued widespread use of these courses makes it necessary to find ways for improving their content and delivery. In response, several researchers, particularly Mayhew and Simpson (1996, 2002), have suggested that the traffic safety community find a way to better integrate existing driver education and training programs with GDL. The goal of this integration is to improve the effectiveness of driver education and training, at which point they may actually become effective teen crash countermeasures. To this end, it has been suggested that driver education and training be multi-staged with a pre-driving course teaching the basic knowledge and skills of driving and rules of the road, and a later advanced course that teaches higher-level skills such as risk perception. The major obstacle to implementing such a two-staged system is that parents are not likely to accept having to pay more money for the two courses instead of one. That would make it unlikely that the legislators would support implementing a two-staged system. The findings of this study are indirectly related to traffic injury prevention because home-study courses could be used as an

inexpensive first course in a GDL-integrated two-staged driver education and training system. Because of the low cost and more accommodating scheduling associated with home-study courses, they may make implementing such a system more acceptable to parents and legislators.

METHOD

Administration and Description of Instruction Methods

This study compared the safe driving knowledge and attitude exit examination scores, and first-attempt DMV written test results, for teens administered driver education at one of 30 commercial driving schools throughout California through one of the following methods: (a) classroom instruction, (b) a computer home-study CD-ROM course, (c) a workbook home-study course, and (d) the Private Educational Network (PEN) Internet/workbook home-study course. The content of all four courses was based on a standardized driver education curriculum. The classroom course was the instruction method to which all the other courses were compared to evaluate their relative effectiveness.

Study Procedures

For students at a participating provider school to be eligible to participate in the study, they must have been 15 to 17 years old, able to read English at or above the seventh grade level, and not have been licensed previously. After collecting a standardized course fee and a signed Parent/Guardian Release Statement, the provider schools determined which type of driver education instruction the student was to receive using a random assignment method created by the department. If the student had access to a computer that would allow the use of the CD program, he or she was eligible to be randomly assigned to any of the four instruction methods. Otherwise, he or she was eligible to be randomly assigned to one of the three instruction methods other than the CD program. Sub-analyses were completed separately for students in the two random assignment groups to assess any potential bias introduced by having separate random assignment schemes for those with or without access to a computer.

Outcome Measures for Study Comparisons

DMV-Proctored Exit Examination

After students in the study completed their driver education course, they were required to return to the provider's school site within two weeks to take a DMV-proctored exit examination. This exit examination was created by the department for use in the study and contained 40 items used to measure knowledge of rules of the road and safe driving practices as presented in the standardized curriculum. The examination also contained 15 items used to measure safe driver attitudes along an

internal-external locus of control continuum, similar to Montag and Comrey's (1987) Driving Internality and Driving External-ity Scales. These authors demonstrated that having more of an internal locus of control was associated with lower involvement in fatal crashes. Higher overall safe driver attitude scores indicate a more internal locus of control, and hence would be expected to be associated with safer driving. The exit test represented the best and most reliable criterion for evaluating the relative effectiveness of the different courses because of its close proximity to course completion and high level of security in its administration.

DMV Written Knowledge Test

The third criterion measure used to compare the relative effectiveness of each of the courses was the students' pass/fail performance on their first attempt taking the 46-item DMV written knowledge test. This test is required by the department for all driver license applicants under the age of 18, and must be passed to receive a behind-the-wheel instruction permit. Test takers are allowed to miss up to eight items (i.e., they must answer at least 38, or 83%, of the items correctly) to receive a passing score on the test.

Data Analysis Strategy

The overall analyses compared the students in the four instruction methods as assigned by the driving schools, regardless of whether or not the assignment was done correctly (i.e., randomly). For whatever reason, a total of 193 students (14.6%) were incorrectly assigned and the correctness of assignment could not be determined for an additional 48 students (3.6%) for whom the information necessary to make this determination was missing. The analyses of first-attempt written test outcomes are based on the 54.6% of students who were not simultaneously enrolled in driver training, because simultaneously-enrolled students are allowed to take the DMV written knowledge test before they actually complete their driver education course. To assess the degree to which these factors, and having separate random assignment schemes based on computer ownership, may have biased the results of the evaluation, additional "bias check" sub-analyses were conducted: (a) only for students who were correctly randomly assigned by the schools, (b) separately for students in (a) who were and were not simultaneously enrolled in a driver training course (with the exception of written test outcomes, as discussed above), and (c) separately for (b) students who did and did not have access to a computer when they were randomly assigned to their driver education course.¹

¹A more extensive review of existing home-study driver education programs, additional information about the home-study courses and study methodology, and some supplementary statistical analyses not presented here are available in a monograph *The Effectiveness of Home-Study Driver Education Compared to Classroom Instruction: The Impact on Student Knowledge, Skills, and Attitudes* (Masten, S. V. & Chapman, E. A. [2003]. Report No. 203. Sacramento: California Department of Motor Vehicles).

RESULTS

Study Participants

A total of 1,493 driver education students volunteered and were enrolled in the study. The total number and percentage of students assigned to each instruction method, and the numbers and percentages dropping out, failing to complete the course by the end of the study, and successfully completing each course are shown in Table I.

The results do not suggest that students dropped out of the study to avoid a particular type of course or because they did not want the course to which they were assigned. Any bias in the study results caused by these students dropping out would be minimal given the very low dropout frequency. However, the results did indicate that a higher percentage of students assigned to classroom instruction, and an even higher percentage of students assigned to the PEN course, failed to complete their course compared to those assigned to either the CD-ROM or workbook instruction methods. There are likely qualitative differences (for example possible different motivation levels) between the students who did and did not complete each course. Any potential bias introduced into the study results by this difference would be expected to have a stronger effect on comparisons involving PEN (because PEN has the highest noncompletion rate), and to a lesser extent, classroom instruction.

Exit Exam Knowledge Comparisons

The overall one-way ANOVA on exit exam knowledge scores was statistically significant, $F(3, 1317) = 13.59$, $MSE = 19.37$, $p < .05$, $\eta^2 = .03$. Tukey post hoc tests for these results indicated that students completing the CD ($M = 29.42$) or PEN ($M = 29.22$) courses scored significantly higher on the knowledge portion of the exit exam compared to students taking a classroom course ($M = 27.57$). Students who completed the workbook ($M = 28.01$) did not significantly differ from classroom students. Although there was some variation, this pattern of

Table I Number (n) and percentage of students who enrolled in each instruction method, dropped out, did not complete the course by the end of data collection, and successfully finished

Instruction method	Enrolled		Dropped out ^a		Did not complete ^b		Successfully finished	
	n	%	n	%	n	%	n	%
PEN	162	10.9	4	2.5	39	24.1	119	73.5
Classroom	356	23.8	9	2.5	44	12.4	303	85.1
CD-ROM	443	29.7	8	1.8	28	6.3	407	91.9
Workbook	532	35.6	7	1.3	33	6.2	492	92.5
Total	1,493	100.0	28	1.9	144	9.7	1,321	88.5

^aDropout rates were not significantly different, $\chi^2(3, N = 1,493) = 2.05$, $p = .56$.

^bNon-completion rates were higher for PEN and classroom than for the CD-ROM or workbook, $\chi^2(3, N = 1,493) = 54.56$, $p < .05$.

results was consistent across the various bias check analyses. In fact, under no situation did the home-study students perform significantly worse than those who completed classroom instruction on exit exam knowledge. The CD and PEN students performed better than did those completing the workbook ($ps < .05$) for some of the sub-analyses.

Exit Exam Safe Driver Attitude Comparisons

The results of the overall one-way ANOVA for safe driver attitudes indicated only one significant difference between the classroom and home-study students, $F(3, 1303) = 2.90$, $MSE = 56.41$, $p < .05$, $\eta^2 = .01$. Specifically, among workbook ($M = 69.33$), CD ($M = 70.41$), and PEN ($M = 69.69$) home-study students, those completing the CD course had better attitudes than did those who completed the classroom course ($M = 68.82$; $p < .05$). Again, the pattern of results was fairly consistent across the different bias check sub-analyses. Therefore, with the possible exception of better attitudes for CD students, those who completed the various home-study driver education courses had safe driver attitudes that were similar to those for students completing a classroom course.

First-Attempt DMV Written Knowledge Test Pass Rate Comparisons

The first-attempt written test analyses are based only on the 721 students with a valid written test score who did not simultaneously enroll in driver training, because of reasons discussed earlier. The overall one-way ANOVA comparing the DMV written knowledge test pass rates was statistically significant, $F(3, 717) = 2.69$, $MSE = 0.22$, $p < .05$, $\eta^2 = .01$. The first-attempt written test pass rates for students in the workbook (64.3%), CD (62.7%), and PEN (65.9%) home-study courses were all directionally worse than the pass rate for classroom students (75.6%), although only the difference between the CD and classroom courses was statistically significant ($p < .05$). None of the home-study course pass rates were significantly different from each other ($ps > .05$), and the pattern of results was again consistent across the various bias check analyses.

DISCUSSION AND CONCLUSIONS

Home-Study Compared to Classroom Instruction

The findings provide no compelling evidence that the home-study courses were inferior to classroom instruction in teaching the driver education curriculum. Rather, students taught under the home-study options performed as well or significantly better on the study exit exam knowledge and safe driver attitude measures. However, classroom students did perform better than home-study students on the DMV written knowledge

test. These findings from the overall analyses were generally consistent across the different bias check analyses that were conducted.

The fact that classroom students did better than home-study students on the DMV written knowledge test is considered less important in the determination of home-study driver education effectiveness than the finding that the classroom students performed the same as, or worse than, home-study students on the study exit exam knowledge and attitude measures. This is because the DMV written knowledge test questions are based on a very small portion of the material in the standardized curriculum, and therefore only a very small portion of what is deemed important to be taught in a driver education course. The study exit exam knowledge test covered much more of the material that the department deemed important for teens to learn. Because of this, the exit exam is considered a much more content-valid measure of the material that is supposed to be taught in a driver education course than is the DMV written test, and therefore a better outcome measure for the study.

The exit exam was also considered a more valid and reliable measure of driver education knowledge for three other reasons. First, the exit exam was pilot-tested to ensure that it could discriminate between those with and without the requisite knowledge. Second, it occurred closer in time to the students' course completion than the DMV knowledge test and therefore was less subject to the students' studying and forgetting following completion of the course. Third, the content of the exit exam was kept secure by having DMV employees proctor the tests at the school sites. This final precaution would have prevented, for example, a particular course provider from learning the content of the exit exam and then focusing primarily on that subject matter in their classroom course. This is a considerable problem with the DMV written test outcome measure because DMV personnel routinely return completed tests to applicants. Driving schools have been known to create tests composed of the exact questions on the DMV written knowledge tests and administer them to their classroom students as part of the normal course procedure.

Some qualification of the findings is necessary due to the higher dropout rates for the PEN and classroom courses. Specifically, the higher percentage of students who did not complete the classroom and PEN courses could have biased some or all of the comparisons in favor of students who completed these courses, especially those completing PEN, given the higher dropout rate for this instruction method. However, any favoring of classroom over home study as a result of its higher course noncompletion rate did not result in classroom students performing better than home-study students on the exit exam outcomes.

Impact on Industry

The findings that home-study courses are at least as effective as classroom courses in teaching the driver education curriculum offers support for allowing the continued and

possibly more widespread use of home-study driver education courses.

Recall that the use of emerging technology, such as self-paced interactive multimedia training and testing, has been recommended by some traffic safety researchers as one way of possibly improving the effectiveness of driver education and training instruction (e.g., Anderson et al., 2000; Lonero, 2001; Lonero et al., 1995; Mayhew & Simpson, 2002; Smith, 2001). The findings of this evaluation support the usefulness of multimedia technology for teaching driver education as compared to other methods. The evidence suggests that students who completed the courses involving computer-based and internet instruction performed better on the exit examination knowledge test than did those in the purely paper-based workbook and classroom courses. The results even suggest that computer-based courses can result in somewhat better student attitudes about safe driving.

Traffic safety researchers have also suggested other means of improving driver education and training, such as by integrating these courses with GDL programs (e.g., Mayhew & Simpson, 1996, 2002; Williams & Mayhew, 2003). In addition, they have recommended that driver education and training be multi-staged, with a basic driver education course before teens learn how to drive, and an advanced course after they have gained some experience driving on the road (NHTSA, 1994). More complex topics, such as risk perception, might be better taught in the advanced course, where experience on the road might make these topics more understandable. Two possible roadblocks to implementing such a two-staged GDL-integrated system would be the prohibitive cost and time requirements of multiple courses for parents. Finding that home-study instruction, particularly the computer-based courses, were effective educational methods for driver education, suggests that the use of the home-study courses as part of these two-staged driver education systems may make their implementation more feasible and acceptable. Such courses, once made, are relatively inexpensive to maintain, and could be distributed at low cost to driver education providers to sell to the public. This, in turn, would place minimal demand on the finances and time of parents, and possibly reduce their resistance to implementing two-stage GDL-integrated driver education and training systems. Home-study courses may also have the additional benefit of increasing parental involvement in their teen's learning process, which has been shown to be an important factor in the effectiveness of graduated licensing laws in general (Graham, 2002; Simons-Morton & Hartos, 2003).

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