Accident liability of novice drivers

Prepared for Department of the Environment, Transport and the Regions

R West and J Hall (St George's Hospital Medical School)

TRL is committed to optimising energy efficiency, reducing
waste and promoting recycling and re-use. In support of these
environmental goals, this report has been printed on recycled
paper, comprising 100% post-consumer waste, manufactured
using a TCF (totally chlorine free) process.

CONTENTS

Executive Summary

This report describes a study in which measures taken during driver training were used to predict subsequent driving test outcome and accident liability in the year following the test for those that passed. The sample consisted of 809 learner drivers who had had at least five lessons, had not previously taken the driving test and were under 20 years of age.

1 Passing the driving test was positively related to pupils' prior assessment of their skill, instructor ratings of pupils' skill, responsiveness to instruction, confidence, safety, how good a driver pupils would be after the test, how careful pupils were in their decision making, and hours of practice. It was negatively related to instructors' ratings of pupils' reliance on instruction. It was not significantly related to hours of tuition.

2 An index was derived combining hours of practice, instructor ratings of how good the pupil would be after the test and reliance on instruction. Pupils scoring 5 or below on this index had a 33% chance of passing the test compared with a 75% chance for those with a score of 10 or more.

3 Controlling for miles driven, accident risk in the first six months following the test was positively related to pupil's pre-test ratings of their chances of having an accident, positive attitude to deviant driving, and social deviance. It was negatively related to pupils' pre-test ratings of their future safety, and how good a driver they would be after the test.

4 Controlling for miles driven, accident risk in the first six months following the test was positively correlated with instructors' pre-test ratings of pupils' reliance on instruction. It was negatively related to instructors' ratings of pupils' pre-test skill levels, how good a driver the pupil would be after the test, the pupils' level of social responsibility and the pupils' carefulness in decision making.

5 Controlling for miles driven, accident risk in the 12 months following the test was positively correlated with pupils' ratings of positive attitude to driving deviance, and social deviance. It was negatively related to pupils' ratings of enjoyment of driving lessons, how good a driver they would be after the test and how safe a driver they would be after the test.

6 Controlling for miles driven, accident risk in the 12 months following the test was positively correlated with instructors' pre-test ratings of pupils' likelihood of accident following the test. It was negatively related to instructors' ratings of pupils' likely attentiveness to the highway code, carefulness in decision making and social responsibility.

7 A score could be calculated for each pupil based on his or her rating of future safety, his or her attitude to deviant driving and instructor rating of how good a driver he or she would be in the future. Pupils in the highest quartile on this score had five times the accident rate in the six months following the test than those in the lowest quartile.

8 Tendency to commit driving violations, tendency to drive fast, general social deviance and a more positive attitude to deviant driving were all associated with accident rates among newly qualified drivers. There was no evidence that more confident drivers were at greater risk of accident.

9 Accident rates, controlling for mileage, were substantially lower in the second six months following the test than in the first six months.

The results indicate that both attitude and skill-related factors are associated with accident risk in novice drivers and that high risk drivers can be identified during driver training. There is a small degree of overlap between factors associated with accident risk and factors associated with likelihood of passing the driving test. They also support previous research suggesting that informal practice has an important role in driver training.

The results raise the possibility that instructors could identify high risk drivers during training and focus on specific remedial measures before the driving test. They also suggest that driving examiners may be able to use cues in driving performance on the test to identify drivers who may be adequate in terms of skill but at high risk of accident because of motivational factors. Finally, the results suggest that encouraging pupils to engage in more informal practice may improve the rate of acquisition of driving skills and increase their chances of passing the test first time. Further research in these four areas should enable these tentative conclusions to be turned into firm recommendations.

1 Introduction

Traffic accidents are a major cause of death and injury world-wide. They also result in many millions of pounds of damage each year. The human factor is believed to play a role in at least 90% of traffic accidents. Evidence over many years has shown that some individuals have a greater risk of involvement in a traffic accident than others (see Elander, West and French, 1993). One group in particular has been shown to have relatively high risk: novice drivers (Maycock, Lockwood and Lester, 1991). This raises the question of whether improvements can be made to basic training and testing to raise the level of safety of new drivers.

This report describes results from a study that examined whether it is possible to use measures taken while individuals are learning to drive to predict accident risk once they have passed their driving test. The discovery of such measures could lead to a technology of detection of high-risk individuals which could in turn be used to target interventions aimed at reducing risk in those individuals. It would also contribute to an understanding of psychological factors underpinning accident risk.

The study also examined predictors of driving test outcome and how far formal tuition and practice would contribute to the acquisition of driving skill. Comparison of predictors of test outcome with predictors of accident rates following the test would provide an indication of the extent to which the current driving test was assessing driver characteristics that were relevant to safety.

In addition, the study looked at relationships between driver characteristics measured six months and 12 months after the driving test and accident liability and provided an opportunity to examine changes in accident rates over the first year following the driving test.

1.1 Factors associated with driver safety

There are two main aspects of driving that might in principle influence accident risk. The first is driving skill. Accidents may be caused by difficulty in maintaining control of the vehicle, responding appropriately or in a timely manner to events, or inadequate observational skills. Novice drivers in particular may suffer from this problem. Car handling ability would be expected to be relatively poorly developed given that the opportunity to practice each manoeuvre while undergoing driver training is limited. The ability to recognise hazards quickly is poor in novice drivers (McKenna and Crick, 1993) and long hazard detection latency is associated with increased accident risk (Quimby, Maycock, Carter, Dixon and Wall, 1986).

The second possible aspect of driving that may contribute to accident risk is driving style. This concerns the way that drivers habitually drive or choose to drive. It includes such things as speed choice, choice of distance to the vehicle in front, tendency to commit driving violations, and adopting a reckless or careless approach. The constellation of factors that include tendency to commit violations, excessive speed, carelessness, impatience and aggressive driving may be labelled 'motivated bad driving'. This constellation and its components have been reliably shown to be associated with accident risk, and

particularly risk of 'active accidents' (accidents for which the driver's behaviour was at least partly responsible - (e.g. Parker, West, Stradling and Manstead, 1995; Reason, Manstead, Stradling, Parker and Baxter, 1991; West, 1994; West, 1997a; West and Hall, 1997)). West (1994) has reported that tendency to commit driving violations, tendency to drive fast, drinking and driving, inattentiveness and intolerance were all associated with higher accident rates in drivers during the first three years since passing the test.

The question arises as to what psychological factors may lead to poor driving skill in novice drivers and an increased tendency towards motivated bad driving. As regards skill, individuals differ in the rate of learning of control and observational skills and in the levels of skill that are ultimately achieved. Many reasons may be proposed such as basic eye-hand co-ordination, speed of response, perceptual acuity, and ability to focus and sustain attention. In relation to this, it has been shown in several studies that ability to switch attention rapidly is worse in accident-involved drivers (see Elander *et al.,* 1993 for a review). It seems likely that basic aspects of psychomotor skill and driving skill would show themselves relatively early in driving training and could be detected at that stage.

With regard to motivated bad driving, it has already been noted that attitude to deviant driving is related to accident rates. In addition, two broad behavioural characteristics have been found to be related to accident risk: social deviance and careless decision making. Three recent studies have shown a relationship between social deviance and accident rates controlling for miles driven. Two of these used the Social Motivation Questionnaire (West, Elander and French, 1993; West and Hall, 1997) as a measure of 'mild' social deviance within the population of normal adult drivers in the UK population. The third (West, 1997b) showed that the KPF-30 (a problem behaviour scale) and past criminal convictions independently predicted accident rates in a large sample of Bratislavan bus drivers. Careless decision making as measured by the Thoroughness subscale of the Decision Making Questionnaire was shown to be related both to past accident history and future accident likelihood taking account of miles driven (West, Elander and French, 1992). Measures of attitudes to driving and broad behavioural characteristics may be particularly useful in predicting accident rates among novice drivers because they can be used with people who have not yet acquired specific attitudes to driving through their own experience.

If it turned out that motivational variables such as attitude to driving deviance measured during driver training were predictive of accident rates post-test, the question would arise as to whether these also relate to driving test outcome. Thus it is of interest to know how far test outcome relates an examiner's perception of the driver's propensity to drive safely as well as his or her perception of the skill of the pupil. If motivational measures that predict accident rates are also correlated with test outcome, this suggests that examiners are in fact paying attention to safety and driving style. In that event

attention could be focused on the cues that examiners identify in making their judgments so that the judgment process can be formalised and improved upon.

1.2 Acquisition of driving skill and predictors of test outcome

The ability to drive a motor vehicle is important to the mobility of the majority of adults in industrialised countries. Much is known about the way that skills are acquired in the laboratory and in some real-world situations (Newell, 1991). However, little is known about the process of learning to drive (Brown, 1992; Macdonald, 1987). Inferences can be made on the basis of the study of skill acquisition in other areas, but many important practical questions about learning to drive can only be addressed by direct observation and experiment in that domain. One key issue concerns the role of formal tuition with a qualified instructor and informal practice with friends or relatives. For example, according to a recent poll in the UK, 82% of adults were in favour of compulsory professional training prior to licence testing (Quimby, Downing and Callahan, 1991) and 98% of driving test candidates in the UK have taken some professional tuition (Forsyth, 1992). Yet there is no clear evidence to indicate whether professional training improves driver safety or skill over what can be achieved by informal supervised practice.

A recent large study of people undergoing a driving test found that the relationship between prior hours of formal tuition and likelihood of passing the test was highly skewed. The highest pass rates were for those with between 6 to 10 hours of instruction, while those with less hours and those with many more hours of tuition were *less* likely to pass the test (Forsyth, 1992). Number of hours of practice with friends or relatives was positively associated with likelihood of passing the test up to 15 hours with little change thereafter. There are many possible interpretations of these findings. One possibility is that instruction beyond a certain point may be counter-productive whereas informal practice can have beneficial effects independent of formal tuition. The present study examined this issue by looking at adjudged skill and confidence levels of drivers with varying amounts of driving tuition and practice behind them. This would have implications for policy decisions concerning the encouragement of informal practice and making formal tuition mandatory. It would also help to inform individual decisions regarding use of practice and formal tuition. Finally, if practice were shown to be beneficial, driving schools may consider offering practice supervision as an additional service.

Several aspects of skill acquisition are relevant to the issue of what role practice and formal tuition might play in learning to drive. First of all, learning occurs with repetition of behavioural sequences (Welford, 1968). Thus the co-ordination required for control of the vehicle and detection and response to traffic situations would be expected to be acquired to some extent simply through unsupervised practice. However, the dangers involved in having an unskilled driver in control of a vehicle mean that some level of supervision is necessary. Secondly, learning can be enhanced by direct instruction and demonstration

(Newell, 1985). A skilled operator can tell the novice the sequence of actions to be performed to carry out a particular task and can also alert the novice to actions that need to be taken in response to particular events. Repetition of these instructions can be an important part of the learning process. Thirdly, skill acquisition does not occur in a simple linear fashion. There are periods of no improvement, and in general the learning curve becomes shallower with increasing practice according to a 'power law' (e.g. Logan, 1988). Thus after a period of training, some drivers may see little or no improvement either with practice or tuition or both. Fourthly, individuals differ in their ability to acquire particular skills (Ackerman, 1987; 1992). Thus greater amounts of tuition or practice or both may be necessary to achieve a particular level of skill for some individuals than others. Fifthly, feedback on task performance is an important element of skill acquisition. This can be obtained by direct observation or from an instructor (Karl, O'Leary-Kelly and Martocchio, 1993; Newell, 1991). In the case of driving, there is a question of how far instructor feedback or direct feedback from experience helps with the learning process. There is evidence that on occasions reduction in frequency of knowledge of results improves learning (Winstein and Schmidt, 1990). Sixthly, skill acquisition often involves construction of low level action sequences into larger units which can then themselves be combined (Fabiani *et al.*, 1989; Welford, 1976). Instruction and external feedback may play different roles at different stages in this process. Lastly, individuals develop a sense of their own level of competence and this changes as the skill is acquired (Karl *et al.*, 1993; Welford, 1976). This confidence may itself influence performance and may also influence the stage at which the person acquiring the skill believes he or she has reached a particular standard.

In the case of learning to drive, little is known about how formal instruction is carried out and what feedback is provided at what stage. However, a recent review of driver training concluded that the case for benefits of professional tuition was as yet unproven (Horneman, 1993). There is some evidence from an intensive study of a few learner drivers that instructors provide less direct instruction later in the process of learning to drive, and that their instruction focuses on higher level skills rather than skills involved in controlling the speed and direction of the vehicle (Groeger and Clegg, 1994). This would accord with the suggestion that increasing driving experience permits greater attentional resources to be devoted to processing information from the environment rather than to the actions needed to control the vehicle. Duncan *et al.*, (1991) have suggested that where direct feedback is good, simple experience may result in expertise but where it is poor instruction may be needed. The question arises as to what aspects of driving skill involve good direct feedback. Direct feedback can be obtained by practice and indeed a recent survey of UK instructors noted that, while 89% said that they encouraged pupils to practice with friends or relatives, more experienced instructors were less likely to provide this encouragement than were less experienced instructors (Lester, 1996). However, we do not know

whether there is a tendency for tuition to be matched to the changing skill levels of the learners. It is possible, for example, that there is a general tendency for driving instructors to provide too much instruction on some occasions, actually hindering rather than enhancing learning by experience. Neither is it known what role the confidence of the driver, and of the instructor in the driver, play in promoting an appropriate level and style of instruction. It is possible that drivers who lack confidence may elicit more interventions from instructors that work against their confidence increasing.

The issue of confidence may be important in explaining the findings mentioned earlier of the relationship between hours of tuition and likelihood of passing the test (Forsyth, 1992). Drivers with lower levels of ability to learn driving skills may accurately perceive this and seek more tuition prior to taking the test. Yet the additional tuition may not be sufficient to make up for their inherent difficulties. Thus it may not be the case that additional tuition is counter-productive but only that it fails to make up fully for an inherent difficulty in learning to drive. If this is the case, it is noteworthy that there was no similar relationship between practice and likelihood of passing the test (Forsyth, 1992). This raises the possibility that practice may do more to make up for underlying difficulties than formal tuition. However, it is also possible that individuals with high levels of practice are not like those with high level of tuition in that they are inherently more rather than less skilful or confident.

1.3 Research questions

The research presented in this report set out to answer six main questions:

1 What characteristics of learner drivers are associated with increased risk of accident within the first six and 12 months of having passed the driving test?

2 Is it possible to develop an index for pupils using measures taken during training that would be of use in assessing future accident risk?

3 What characteristics of learner drivers are associated with increased likelihood of passing the driving test and how do these overlap with measures that predict accident rates?

4 What relationships exist between prior hours of tuition and informal practice and currently assessed level of driving skill during driver training and between hours of tuition and practice and likelihood of passing the driving test?

5 What relationships exist between accident rates following the driving test and attitudes to driving, personality, measures of driving style and self-assessed driving skill taken concurrently?

6 How do accident rates change from the first six months to the second six months following the driving test?

2 Methods and sample

2.1 Overview

Measures of broad behavioural characteristics, attitudes to driving violations, self-ratings and instructor ratings of skill, confidence and forecasts of future skill and safety were obtained from a sample of learner drivers. This sample was followed up and, in those that passed their test first time, measures of driving style, mileage and accident rates were obtained six months and 12 months after the test.

Associations were examined among variables measured during driver training, and in particular how far prior hours of tuition and practice were linked to instructor ratings of current driving skill. Associations were also examined between measures taken during driver training and likelihood of passing the test. Predictors of driving style and accident rates in the first six months and the first 12 months since passing the test and other measures were examined as were relationships among measures taken during training and at six and 12 month follow-up.

2.2 Sample

Instructors with a major UK driving school and a sample of instructors on the Approved Driving Instructor (ADI) register were asked to help with the study by recruiting up to 10 pupils meeting the following criteria:

The pupils were to be under 20 years of age, to have had at least five lessons with the instructor, and to be taking their driving test for the first time.

A total of 272 instructors recruited 809 pupils for whom data were obtained from both pupils and instructors. Of the instructors, 197 recruited two or more pupils; the remainder recruited just one pupil each. Table 1 shows the characteristics of the sample of pupils at the time the first set of measures were taken.

Table 1 Characteristics of subject sample when first surveyed

Mean (SD) age	17.3 (0.61)
Percentage males	41
Mean (SD) hours of tuition	15.8 (10.32)
Percentage with at least some practice	54
Mean (SD) hours of practice among those with at least some practice	9.4 (14.11)

Table 2 shows the number of pupils having undergone varying amount of tuition and practice prior to the survey. There was a significant association between amount of tuition and amount of practice (χ^2=21.8, p<.01).

Table 2 Numbers of pupils in each category of amount of formal tuition and informal practice

		Practice (hrs)			
		0	1-5	6-10	>10
Tuition	**5-10**	135	86	41	27
(hrs)	**11-15**	80	39	25	16
	16-20	56	34	29	22
	>20	84	32	35	35

2.3 Measures

2.3.1 Measures taken during driver training

For the initial set of measures instructors handed their pupil a questionnaire (PQ) and themselves completed a checklist (IC). Pupils and instructors completed their questionnaires/checklists outside the lesson and independently of one another. They returned their questionnaires/checklists separately in FREEPOST envelopes provided. The measures in the pupil questionnaire and instructor checklist included the following.

2.3.2 Pupil questionnaire (PQ)

Self-ratings of current levels of skill were made at judging the width of the car, keeping within the 30 mph speed limit, keeping up with the flow of traffic, correctly positioning the car for a right turn, carrying out a left turn without hitting the kerb, judging the speed of other vehicles, anticipating hazards, spotting potential hazards quickly, adjusting to slippery road conditions, stopping in an emergency, approaching a junction at a speed appropriate to the road layout, positioning the car correctly when approaching a roundabout, and keeping a safe distance from the vehicle in front. The ratings were made on 5-point scales: 1=very poor, 2=poor, 3=fair, 4=good, 5=very good. Pupils were also allowed to indicate if the item was not applicable (i.e. they had not attempted the manoeuvre in question). The coefficient alpha for the scale made up of these ratings was 0.90 showing a high level of internal reliability. A mean score was calculated for the scale as a whole, excluding items that were not applicable because the manoeuvre had not yet been attempted.

Self-ratings were made of enjoyment of driving, confidence while driving, ease of learning to drive, chances of passing the test first time, how good a driver they would be, how safe a driver they would be, and chances of having an accident in the first year after having passed the test. The ratings were made on a 3-point scale: 1=not at all, 2=fairly, 3=very. Each rating was treated separately in the analysis.

Attitude to driving violations was measured using the Attitudes to Driving Violations Scale (ADVS - West and Hall, 1997). This consists of seven statements to which respondents indicate their level of agreement or disagreement. The statements are: decreasing the speed limit on motorways is a good idea; even at night-time on quiet roads it is important to keep within the speed limit; drivers who cause accidents by reckless driving should be banned from driving for life; people should drive slower than the speed limit when it is raining; cars should never overtake on the inside lane even if a slow driver is blocking the outside lane; in towns where there are a lot of pedestrians the speed limit should be 20 mph; penalties for speeding should be more severe. Ratings were made on a 5-point scale: 1=strongly agree, 2=agree, 3=neither agree nor disagree, 4=disagree, 5=strongly disagree. The ratings are summed to produce a single score ranging from 7 to 35. The scale has been shown in adult drivers to be associated with fast driving and accident risk, taking account of age, sex, driving experience and mileage (West and Hall, 1997). The coefficient alpha for the scale on this sample was 0.60 which

shows low to moderate internal reliability. West and Hall (1997) found a coefficient alpha of 0.74.

Thoroughness in decision making was measured using the thoroughness subscale of the Decision Making Questionnaire (West et al., 1992). This consists of four items: how often do you plan well ahead; how often do you make decisions without considering all of the implications; how often do you work out all the pros and cons before making a decision; how often is your decision making a deliberate logical process. Ratings were made on a 5-point scale: 1=very infrequently or never, 2=infrequently, 3=quite infrequently, 4=frequently, 5=very frequently or always (except for the second item where the scoring is reversed). The ratings were summed to produce a single score ranging from 4 to 20. This score has been shown in adult drivers to be associated with fast driving and accident risk, taking account of age, sex, driving experience and mileage (West et al., 1992). The coefficient alpha for the scale was 0.64 for the present sample which shows low to moderate internal reliability.

Mild social deviance was measured using the Social Motivation Questionnaire (West et al., 1993). This consists of 10 items. Respondents are asked how likely it is that they would engage in various anti-social behaviours if they could be sure of getting away with it: riding on public transport without paying a fare; parking on double yellow lines; earning cash payments without paying income tax that is owed; leaving a shop with goods that have not been paid for; making a fraudulent insurance claim; keeping a £20 note found in the street; hitting someone who has annoyed or upset them; owning and watching a TV without having a licence; taking time off work or studies 'sick' when they have something more interesting to do; and driving down the hard shoulder of a motorway when all the other lanes are jammed. Responses are made on a 3-point scale: 1=not at all likely, 2=quite likely, 3=very likely. Ratings are summed to produce a single score ranging from 10 to 30. The coefficient alpha for the scale was 0.74 on this sample.

Total hours of professional tuition, and total hours of practice with friends or relatives were recorded. Given that most of the pupils would have received most or all of their formal instruction from their current instructor it was possible to obtain an approximate indication of the accuracy of their estimates of tuition received by correlating these with instructor estimates of how many hours tuition they had given the pupils. This correlation worked out at r=0.74 showing a high level of agreement between pupils' and instructors' estimates of prior hours of formal tuition. For some of the statistical analyses, hours of tuition were categorised as follows: 5-10, 11-15, 16-20, >20, and hours of practice were grouped into: 0, 1-4, 5-10, >10. The groupings were based on the need to cover the extremes as far as possible while maintaining enough respondents in each category for reliable statistical estimation.

Pupils also provided information on their age and sex.

2.3.3 Instructor checklist (IC)

Pupils' current driving skill was assessed using 13 ratings identical to those described above given by the pupils themselves. The alpha for the scale was 0.84 on this

sample. Items were averaged to produce a single score from 1 to 5. For some pupils, certain items were considered to be not applicable because they had not attempted that manoeuvre. Items that were not applicable were excluded from the average.

Instructors also rated the pupils in terms of their confidence, reliance on instruction, and responsiveness to instruction, how safe the instructor felt with them, how good a driver they would be once they passed their test, how safe a driver they would be, how fast a driver they would be, how attentive they would be to the highway code, how likely they would be to have an accident within the first year of passing the test, how socially responsible they were and how carefully they evaluated courses of action. Ratings were made using 5-point ratings: 1=much less than average, 2=less than average, 3=average, 4=more than average, 5=much more than average. Each rating was treated separately in the analysis.

2.3.4 Test outcome card (TC)

Both pupils and instructors were asked to return a postcard (using FREEPOST) indicating the result of the test when taken, the date of the test, and whether the pupil had changed instructors prior to the test. The duplication was to minimise loss of subjects to follow-up. Subjects who had not returned a TC after 6 months were sent a reminder.

2.3.5 Six month follow-up questionnaire (6MFQ)

Six months after pupils had passed their driving test, they were sent a postal questionnaire, to be returned when completed in a FREEPOST envelope. Up to two reminders were sent. The 6MFQ included the following measures:

Rating of ability to cope with traffic situations on 4-point scale: 1=unable to cope with any situation, 2=unable to cope with most situations, 3=able to cope with most situations, 4=able to cope with any situation.

Ratings of speed, accident likelihood, skill, cautiousness, compared with other drivers of same age and sex on 5-point scale: 1=much less/lower than average, 2=less/lower than average, 3=average, 4=more/higher than average, 5=much more/higher than average.

Score on a modified version of the violations scale of the Driver Behaviour Questionnaire (Reason *et al.*, 1991). This consisted of 11 ratings of frequency of committing particular driving violations (overtaking on the inside, driving on dipped lights on quiet roads, flashing drivers to get out of the way, racing other drivers, disregarding speed limits at night or early in the morning, racing to beat oncoming vehicles to narrow gaps, crossing lights on red, disregarding red lights on quiet roads, taking attention from road to carry out other tasks, overtaking in risky circumstances, chasing other drivers in anger. The scales were 1=never, 2=hardly ever, 3=occasionally, 4=quite often, 5=frequently, 6=nearly all the time. The coefficient alpha for the scale was 0.77 in this sample. Ratings were added together to produce a single score between 11 and 66.

The speed subscale of the Driving Style Questionnaire (West *et al.,* 1992). This consisted of three 6-point scales indicating frequency of: exceeding speed limits in built up

areas, driving 'fast', exceeding the 70 mph limit on motorway journeys. The scale was: 1=never or very infrequently, 2=infrequently, 3=quite infrequently, 4=quite frequently, 5=frequently, 6=very frequently or always. A factor analysis yielded a single factor explaining 67% of the variance. The scale had a coefficient alpha of 0.74 in this sample. Ratings were added to yield a score between 3 and 18.

The calmness subscale of the Driving Style Questionnaire (West *et al.,* 1992). This consisted of three 6-point scales indicating frequency of remaining calm in difficult traffic situations, becoming flustered and feeling pressure from other motorists. The rating used were the same as for the speed scale of the DSQ. The coefficient alpha for the total scale in the present sample was 0.66. Ratings were added, with the scoring of the fluster and pressure ratings reversed, to yield a score between 3 and 18.

DWI - reports of how frequently they drove when they thought they might be over the legal alcohol limit on a 6-point scale: 1=never or very infrequently, 2=infrequently, 3=quite infrequently, 4=quite frequently, 5=frequently, 6=very frequently or always.

The number of accidents since passing their test. Accidents were defined as any collision while driving resulting in damage to the vehicle, another vehicle or property or resulting in injury to a person.

Number of hours of tuition and informal practice they had undergone prior to taking their test. Mileage since passing their test was also reported.

2.3.6 12 month follow-up questionnaire (12MFQ)

At 12 months following the driving test, pupils were sent a questionnaire containing the following measures: number of miles driven since passing the test; the DBQ violations scale as used in the 6MFQ; the DSQ speed scale as used in the 6MFQ; the SMQ deviance scale as measured in the PQ; the ADVS attitude scale as measured in the PQ; number of accidents since passing the driving test (including the period covered by the 6MFQ); licence endorsements for moving traffic offences obtained from the Driver and Vehicle Licensing Agency (with written permission); and self-reports of the number of times drivers have been charged with a moving traffic offence.

Drivers also reported the fastest speeds at which they felt comfortable driving on: open single carriageway roads, motorways and urban roads.

Drivers were asked to return the completed questionnaire using a FREEPOST envelope provided. Up to two reminders were sent.

A full list of the measures taken during the study is given in Table 3.

2.4 Analyses

Basic descriptive statistics calculated were means and standard deviations in the case of quantitative variables and percentages in the cases of categorical variables.

Bivariate associations were assessed using Spearman rank order correlation coefficients in the case of quantitative variables and chi-squared tests for categorical variables.

Sex differences were assessed for significance using independent groups t-tests.

Table 3 Measures take

Variable	Measure	Theoretical range
Pupil questionnaire		
1. Mean current skill rating	Scale	1-5
2. Confidence while driving	Single rating	1-3
3. Enjoyment of driving lessons	Single rating	1-3
4. Ease of learning to drive	Single rating	1-3
5. Chances of passing test	Single rating	1-3
6. How good will be after test	Single rating	1-3
7. How safe will be after test	Single rating	1-3
8. Chances of accident in first year after test	Single rating	1-3
9. ADVS attitude	Scale	7-35
10. DMQ thoroughness	Scale	4-20
11. SMQ deviance	Scale	10-30
12. Hours of tuition	Recall	5-
13. Hours of practice	Recall	0-
Instructor checklist		
14. Mean current skill rating	Scale	1-5
15. Pupil's reliance on instruction	Single rating	1-5
16. Pupil's responsiveness to instruction	Single rating	1-5
17. Pupil's confidence in driving ability	Single rating	1-5
18. How safe feel with pupil	Single rating	1-5
19. How fast pupil will be after test	Single rating	1-5
20. How good a driver pupil will be after test	Single rating	1-5
21. Pupil's likelihood of accident in first year after test	Single rating	1-5z
22. How attentive to Highway Code pupil will be after test	Single rating	1-5
23. How careful pupil is in evaluating courses of action	Single rating	1-5
24. How socially responsible pupil is	Single rating	1-5
Test outcome card		
25. Passed, failed or not taken	Recall	
26. Changed instructor	Recall	
6 month follow-up		
27. Mileage since test	Recall	0-
28. Ability to cope with traffic situations	Single rating	1-4
29. Speed compared with other drivers	Single rating	1-5
30. Accident likelihood compared with other drivers	Single rating	1-5
31. Skill compared with other drivers	Single rating	1-5
32. Cautiousness compared with other drivers	Single rating	1-5
33. DBQ violations	Scale	11-66
34. DSQ speed	Scale	3-18
35. DSQ calmness	Scale	3-1
36. DWI	Single rating	1-6
37. Accidents	Recall	0-
12 month follow-up		
38. Mileage since test	Recall	0-
39. DVLA endorsements	Official record	0-
40. Self-reported traffic offence charges	Recall	0-
41. Comfortable speed on open road	Estimate	0-
42. Comfortable speed on motorway	Estimate	0-
43. Comfortable speed on urban road	Estimate	0-
44. DBQ violations	Scale	11-66
45. DSQ speed	Scale	3-18
46. SMQ deviance	Scale	10-30
47. ADVS attitude	Scale	7-35
48. Accidents since test	Recall	0-

Multivariate prediction of behavioural variables other than accidents was undertaken using multiple regression assuming a normal distribution for the residuals. For prediction of accident rates a Poisson distribution was assumed for residuals and relationships between predictor variables and accident rates were expressed as 'rate ratios' (see below).

Instructors' and pupils' skill and confidence ratings were compared across the tuition and practice categories by two-way analysis of variance with amount of practice and amount of tuition as the independent variables. Polynomial contrasts were used to examine linear and non-linear relationships for main effects and the interaction.

Because 81 of the instructors provided ratings for more than one pupil the possibility arose of non-independence among some of the data points. The presence of such non-independence would be manifest in terms of correlations of greater than 0 between scores for pupils with the same instructors. The actual correlations for ratings given to different pupils by examiners averaged 0.04 and in no cases did they approximate statistical significance. Therefore there was no evidence to suggest that data points provided by the same examiners were statistically related.

3 Results for measures taken during driver training

3.1 Descriptive statistics

Table 4 shows the basic descriptive statistics for the measures obtained. The pupils generally enjoyed their lessons and were moderately confident. As a group they believed they would be good and safe drivers after passing the test and were unlikely to have an accident. Their self-ratings of specific driving skills were quite high and slightly higher than those that their instructors gave them (t=6.9, p<.001 for comparison between instructor and pupil ratings).

The instructors generally rated their pupils quite highly. It is worth noting that the instructors rated their pupils as generally above average in terms of future driving ability and safety (average would yield a score of 3 and the scores given by instructors were greater than 3). Pupils were also rated highly on social responsibility and carefulness in decision making.

There was clear evidence that the males considered themselves more skilful than did the females. They were also more confident and enjoyed their lessons more. However, they expressed greater acceptance of deviant driving and were higher in general social deviance. Instructors rated male pupils as more confident than female pupils and less reliant on instruction. Male pupils were considered by instructors to be less socially responsible and likely to driver faster. Instructors also believed that the males would be more likely to have an accident and be less attentive to the Highway Code.

3.2 Correlations between measures

Table 5 shows correlations among the measures in the pupil questionnaire. There were modest but significant associations between enjoyment of lessons and confidence, ease of learning, and self-adjudged skill and safety. Of particular note is the positive correlation between SMQ deviance and a positive attitude to driving deviance. Also pupils with a positive attitude to driving deviance generally believed that they would be less safe drivers in the future and enjoyed driving lessons less.

Pupils with more prior hours of tuition judged themselves to be slightly more skilful but enjoyed their

Table 4 Means and standard deviations of measures taken during driver training

		Males		Females	
		Mean	SD	Mean	SD
Pupil questionnaire					
1.	Mean current skill rating**	3.8	0.46	3.7	0.46
2.	Confidence while driving***	2.3	0.48	2.2	0.41
3.	Enjoyment of driving lessons*	2.7	0.48	2.6	0.50
4.	Ease of learning to drive***	2.2	0.45	2.0	0.41
5.	Chances of passing test***	2.2	0.51	2.0	0.47
6.	How good will be after test	2.4	0.53	2.4	0.49
7.	How safe will be after test	2.6	0.53	2.6	0.51
8.	Chances of accident in first year after test	1.5	0.59	1.5	0.56
9.	ADVS attitude***	17.9	3.93	16.3	3.48
10.	DMQ thoroughness	13.9	2.55	13.9	2.55
11.	SMQ deviance***	15.0	3.33	14.2	3.00
12.	Hours of tuition***	14.0	8.82	17.0	11.00
13.	Hours of practice	5.7	14.21	4.6	8.71
Instructor checklist					
14.	Mean current skill rating	3.5	0.59	3.4	0.54
15.	Pupil's reliance on instruction***	2.7	0.94	2.9	0.95
16.	Pupil's responsiveness to instruction	3.8	1.02	3.8	0.99
17.	Pupil's confidence in driving ability***	3.5	0.89	3.0	0.88
18.	How safe feel with pupil	3.5	0.89	3.4	0.86
19.	How fast pupil will be after test***	3.3	0.76	3.0	0.70
20.	How good a driver pupil will be after test	3.5	0.77	3.6	0.68
21.	Pupil's likelihood of accident in first year after test***	2.7	0.90	2.5	0.81
22.	How attentive to Highway Code pupil will be after test**	3.0	0.84	3.2	0.71
23.	How careful pupil is in evaluating courses of action	3.3	0.83	3.4	0.81
24.	How socially responsible pupil is***	3.6	0.86	3.8	0.82

*Note: *p<.05, ** p<.01, *** p<.001 for comparison between males and females*

lessons less. Pupils with more practice believed themselves to be slightly more skilful. Issues relating adjudged skill to tuition and practice are dealt with in more detail later.

Table 6 shows correlations among the measures in the instructor checklist. Instructors' ratings were quite highly related to each other. Thus pupils who were judged as

skilful were judged to be safer, likely to be attentive to the highway code, less likely to have an accident, more socially responsible and more careful in their decision making.

Table 7 shows correlations between measures in the pupil questionnaire and the instructor checklist. Generally speaking, correlations between pupil ratings of their skills and confidence were only weakly related to instructor ratings. The highest correlations were between the aggregate skill score from pupils and instructors and also between instructor and pupil ratings of pupil confidence. Also of note was that pupils with positive attitudes to driving deviance were judged less likely to be safe drivers in future by instructors.

Prior hours of both tuition and practice were positively related to instructors' ratings of pupil skill. These findings are examined in more detail later.

3.3 The role of practice and tuition in skill and confidence

Figures 1 to 4 show the mean skill and confidence ratings by instructors as a function of pupils' prior hours of driving tuition and practice. They show a clear increase in ratings of pupil skill ($F_{1,726}=55.6$, p<.0001 for linear contrast), pupil confidence ($F_{1,726}=34.6$, p<.0001 for linear contrast), responsiveness to instruction ($F_{1,726}=19.4$, p<.0001 for linear contrast), and safety ($F_{1,726}=3.2$, p<.0001 for linear contrast) with increasing amount of practice.

There was evidence that driving skill as rated by instructors increased with increasing hours of tuition ($F_{1,726}=5.0$, p<.03 for linear contrast). There was a strong positive association between amount of instruction and prior hours of tuition among pupils who had had no practice ($F_{1,351}=28.2$, p<.0001) but little or no tuition effect in pupils with at least some practice ($F_{1,726}=5.7$, p<.02 for the linear by linear interaction). There was no significant relationship between tuition and instructors' ratings of pupil confidence. There was no relationship between how safe instructors felt with the pupils and prior hours of tuition but there was a significant interaction so that the greatest effect of practice was in pupils with 11-15 hours of tuition ($F_{1,726}=6.7$, p<.01 for the linear by linear interaction). Pupils with more hours of tuition were judged to be less responsive to instruction ($F_{1,726}=7.7$, p<.01 for the linear contrast). It is of interest to note that in the case of all four dependent measures, the highest ratings were obtained for pupils with more than 10 hours of practice and 11-15 hours of tuition.

Table 5 Correlations among measures in pupil questionnaire

|		1	2	3	4	5	6	7	8	9	10	11	12
1.	Skill rating												
2.	Confidence	**.36**											
3.	Enjoyment	**.24**	**.21**										
4.	Ease of learning	**.31**	**.33**	**.21**									
5.	Chances of passing	**.20**	**.19**	**.12**	**.20**								
6.	How good will be	**.32**	**.19**	**.11**	**.17**	**.21**							
7.	How safe will be	**.25**	.07	**.14**	.07	.07	**.36**						
8.	Chances of accident	**-.20**	-.05	**-.09**	-.01	**-.11**	**-.18**	**-.21**					
9.	ADVS attitude	-.08	.06	**-.13**	.05	-.03	-.05	**-.13**	.00				
10.	DMQ thoroughness	**.21**	.08	.06	.03	**.10**	**.11**	**.13**	**-.14**	-.08			
11.	SMQ deviance	-.08	-.03	**-.16**	.00	-.05	-.06	**-.15**	**.15**	**.26**	**-.14**		
12.	Hours of tuition	**.13**	.05	**-.12**	**-.11**	**-.10**	-.08	-.05	.01	.02	.00	-.04	
13.	Hours of practice	**.09**	.06	.06	.08	-.01	-.02	-.04	.02	-.08	-.03	.04	**.09**

Note: Correlations of .09 and higher are significant at p<.01; correlations higher than .12 are significant at p<.001.

**Table 6 Correlations among measures in instructor checklist**

	14	15	16	17	18	19	20	21	22	23
14. Skill rating										
15. Reliance	**-.55**									
16. Responsiveness	**.57**	**-.52**								
17. Confidence	**.39**	**-.45**	**.36**							
18. Feel safe	**.62**	**-.55**	**.55**	**.45**						
19. Fast	.05	**-.18**	.06	**.28**	.06					
20. Good	**.53**	**-.44**	**.52**	**.31**	**.57**	-.03				
21. Likelihood of accident	**-.40**	**.27**	**-.38**	-.13	**-.41**	**.28**	**-.54**			
22. Attentive to HC	**.28**	-.11	**.33**	.06	**.26**	-.22	**.36**	**-.39**		
23. Careful	**.36**	**-.28**	**.43**	.16	**.44**	-.12	**.49**	**-.41**	**.44**	
24. Responsible	**.22**	-.14	**.30**	.05	**.24**	-.22	**.40**	**-.35**	**.38**	**.55**

Table 7 Correlations between items in pupil questionnaire and instructor checklist

	Instructor checklist (see Table 6 for definitions of variables)										
Pupil questionnaire	14	15	16	17	18	19	20	21	22	23	24
1. Skill rating	**.28**	**-.23**	**.15**	**.22**	**.24**	**.12**	**.16**	-.06	.02	-.08	.02
2. Confidence	**.14**	**-.14**	.06	**.25**	**.10**	**.16**	.03	.01	-.04	.00	-.03
3. Enjoyment	**.11**	**-.16**	**.16**	**.15**	**.18**	.02	**.15**	-.05	.06	**.13**	.07
4. Ease of learning	**.14**	**-.20**	**.12**	**.30**	**.16**	**.14**	.09	-.03	-.05	.03	-.01
5. Chances of passing	**.14**	**-.13**	**.12**	**.18**	**.11**	**.11**	.09	-.01	.02	.05	.03
6. How good will be	.06	-.03	.00	**.11**	.01	**.10**	.07	-.04	-.01	-.02	-.02
7. How safe will be	.01	-.01	.04	.03	.04	-.01	.07	-.09	.07	.04	.01
8. Chances of accident	-.03	.00	.00	.02	-.02	.04	-.02	.00	.00	.01	-.01
9. ADVS attitude	-.05	.04	-.02	**-.11**	.01	**-.14**	.07	-.04	.06	.07	**.09**
10. DMQ thoroughness	.01	.01	.05	-.02	.00	-.08	**.11**	-.07	**.10**	**.12**	**.17**
11. SMQ deviance	.01	-.05	-.01	.08	.00	**.15**	-.05	.06	**-.10**	-.03	-.07
12. Hours of tuition	**.20**	.02	-.05	-.03	.03	-.04	-.06	-.03	-.02	-.01	.00
13. Hours of practice	**.25**	**-.16**	**.14**	**.22**	**.20**	.00	**.10**	**-.09**	.02	**.10**	.02
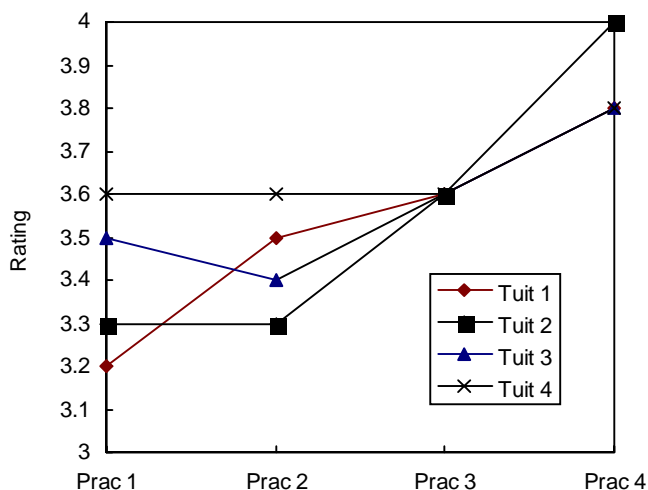
Figure 1 Mean instructor ratings of pupils' driving skill as a function of prior hours of tuition and practice. (Tuition:1=5-10 hours, 2=11-15 hours, 3=16-20 hours, 4=>20 hours; Practice: 1=none, 2=1-4, 3=5-10, 4=>10)
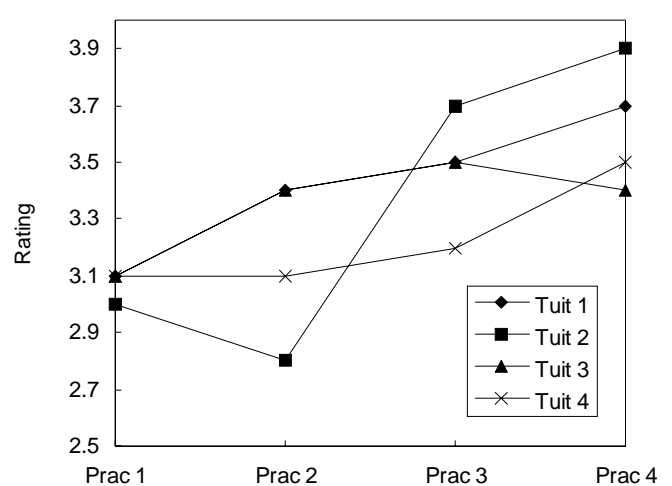
Figure 2 Mean instructor ratings of pupils' confidence as a function of prior hours of tuition and practice. (Tuition:1=5-10 hours, 2=11-15 hours, 3=16-20 hours, 4=>20 hours; Practice: 1=none, 2=1-4, 3=5-10, 4=>10)
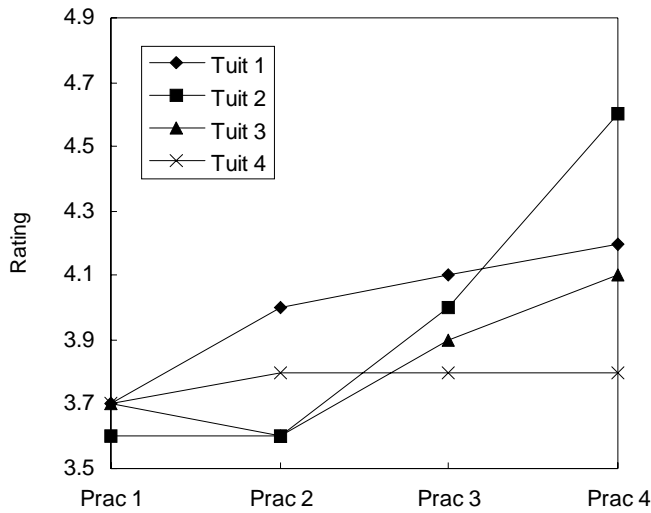
Figure 3 Mean instructor ratings of pupils' responsiveness to instruction as a function of prior hours of tuition and practice. (Tuition:1=5-10 hours, 2=11-15 hours, 3=16-20 hours, 4=>20 hours; Practice: 1=none, 2=1-4, 3=5-10, 4=>10)
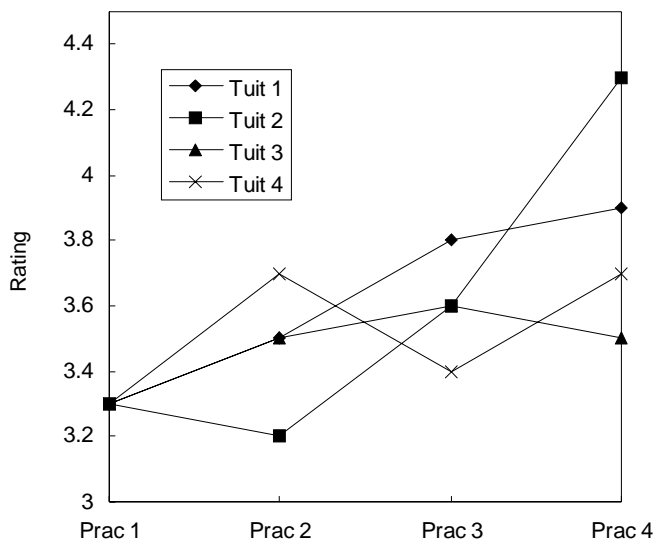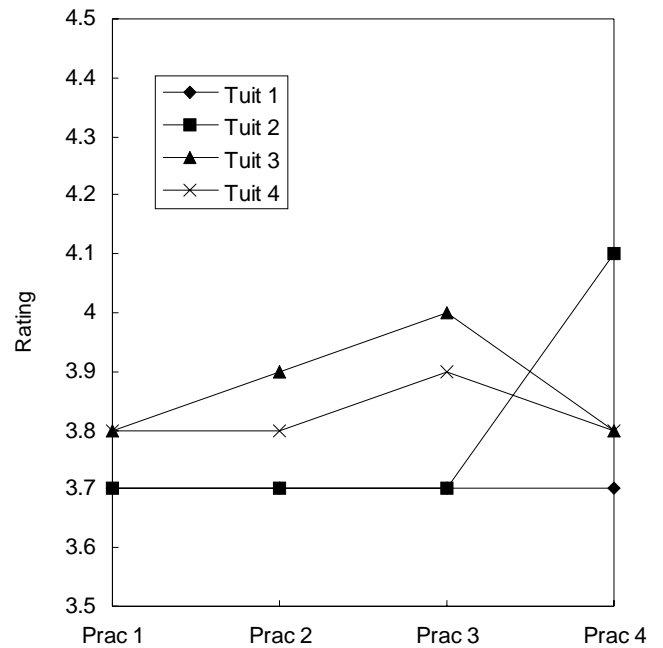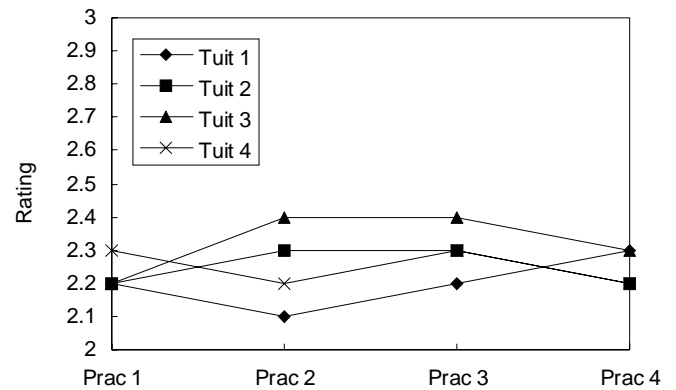

Figure 4 Mean instructor ratings of pupils' driving safety as a function of prior hours of tuition and practice. (Tuition:1=5-10 hours, 2=11-15 hours, 3=16-20 hours, 4=>20 hours; Practice: 1=none, 2=1-4, 3=5-10, 4=>10)

Figures 5 to 8 show the mean skill and confidence ratings of pupils as a function of their prior hours of driving tuition and practice. Pupils with more tuition rated their skill levels higher ($F_{1,726}=7.8$, p<.01 for linear contrast) although the main difference was between those with 5-15 hours and those with more than 15 hours among those with less than 10 hours of practice (Figure 5). Pupils' ratings of their skill levels were unrelated to hours of practice. There was no significant relationship between confidence and either tuition or practice. Ease of learning to drive was weakly negatively related to hours of tuition ($F_{1,726}=4.0$, p<.05 for the linear contrast) and unrelated to amount of practice. Enjoyment of driving was lower at the highest level of tuition than other levels ($F_{1,726}=5.3$, p<.02 for the quadratic contrast). There was no association between hours of practice and enjoyment of driving.

Figure 5 Mean pupil ratings of their driving skill as a function of prior hours of tuition and practice. (Tuition:1=5-10 hours, 2=11-15 hours, 3=16-20 hours, 4=>20 hours; Practice: 1=none, 2=1-4, 3=5-10, 4=>10)

Figure 6 Mean pupil ratings of confidence in driving as a function of prior hours of tuition and practice. (Tuition:1=5-10 hours, 2=11-15 hours, 3=16-20 hours, 4=>20 hours; Practice: 1=none, 2=1-4, 3=5-10, 4=>10)
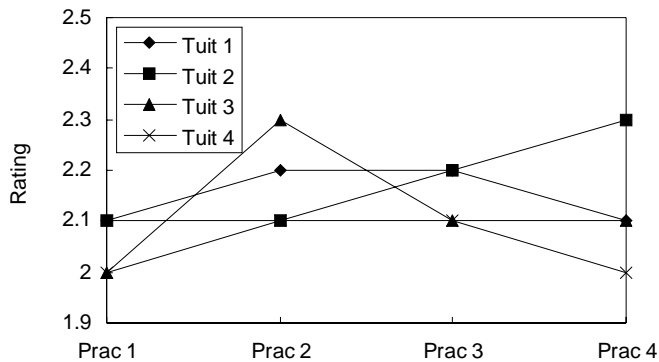
Figure 7 Mean pupil ratings of ease of learning to drive as a function of prior hours of tuition and practice. (Tuition:1=5-10 hours, 2=11-15 hours, 3=16-20 hours, 4=>20 hours; Practice: 1=none, 2=1-4, 3=5-10, 4=>10)
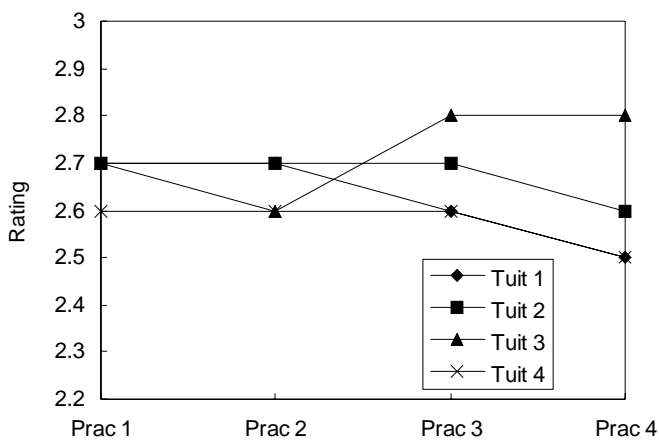
Figure 8 Mean pupil ratings of enjoyment of driving as a function of prior hours of tuition and practice. (Tuition:1=5-10 hours, 2=11-15 hours, 3=16-20 hours, 4=>20 hours; Practice: 1=none, 2=1-4, 3=5-10, 4=>10)

4 Results concerning test outcome

Of the pupils recruited, 399 subsequently reported that they had passed their test (see below), 303 reported having failed, and no test outcome cards were received from 107 (in most cases this would be because of not having taken the test within the follow-up period). The pass rate was very similar to that found in pupils of similar age taking their test for the first time in a large national cohort study (Forsyth, 1992).

Table 8 shows the mean values for variables measured in the PQ and IC for those that passed, failed, or did not report having taken their test within six months. It is apparent that pupils' judgement of their skill was associated with likelihood of passing although the effect was very small. Pupils who subsequently passed had had significantly more hours of practice prior to completing the questionnaire but less hours of tuition. Instructor ratings of pupil skill were clearly higher in those that passed compared with those that failed. Instructor ratings of pupil carefulness were also higher for those that passed. There was no evidence that

Table 8 Mean values on PQ and IC variables for pupils who passed, failed, or did not take their driving test

	Not taken		Failed		Passed	
	Mean	SD	Mean	SD	Mean	SD
Pupil questionnaire						
1. Skill***	3.5	.46	3.7	.48	3.8	.44
2. Confidence*	2.1	.43	2.2	.45	2.2	.45
3. Enjoyment	2.6	.53	2.6	.51	2.7	.47
4. Ease of learning	2.1	.40	2.1	.41	2.1	.43
5. Chances of passing	2.1	.53	2.0	.51	2.1	.47
6. Good	2.4	.50	2.4	.50	2.4	.50
7. Safe	2.6	.56	2.6	.51	2.6	.52
8. Chances of accident	1.5	.59	1.5	.60	1.5	.54
9. ADVS attitude	16.7	4.4	17.0	3.7	17.0	3.0
10. DMQ thoroughness	13.6	2.8	14.1	2.4	13.9	2.6
11. SMQ deviance	14.4	3.6	14.7	3.0	14.4	3.2
12. Hours of tuition*	12.8	8.3	17.2	10.1	15.5	10.6
13. Hours of practice**	3.8	10.6	3.9	7.5	6.3	13.5
Instructor checklist						
14. Skill***	3.0	.66	3.5	.52	3.6	.54
15. Reliance on instruction***	3.4	.95	2.9	.89	2.6	.91
16. Responsiveness***	3.2	.99	3.7	.98	4.0	.94
17. Confidence***	2.8	.99	3.2	.86	3.4	.88
18. Feel safe***	2.9	.84	3.4	.82	3.6	.87
19. Fast	3.0	.79	3.1	.76	3.2	.72
20. Good***	3.2	.80	3.5	.66	3.7	.70
21. Likelihood of accident	2.8	.94	2.6	.83	2.5	.83
22. Attentive to highway code	3.0	.79	3.0	.79	3.2	.74
23. Careful***	3.0	.86	3.4	.79	3.5	.79
24. Socially responsible*	3.3	.94	3.7	.80	3.8	.83

Note: * 'Not taken' significantly different from others, ** 'pass' significantly different from others, *** all groups significantly different from each other (by Scheffe post hoc comparison, p<.05).

pupils who passed differed from others in terms of measures of driving deviance and social deviance.

Sixty-one percent of the males taking the test passed compared with 54% of the females (χ^2=4.3, p<.05).

In order to assess the independent contribution of sex and PQ and IC variables to prediction of test outcome a forward stepwise logistic regression was carried out using only those pupils who had taken their test. Table 9 shows the results of the analysis. It shows that instructor ratings of how good a driver the pupil would be and reliance on instruction made an independent contribution to prediction of test outcome together with prior hours of practice. No other variables added significantly to the prediction of test outcome.

Table 9 Results of forward stepwise logistic regression predicting driving test outcome from PQ and IC variables

Variable	B	S.E.	Odds ratio	Signifi-cance
13. Hours of practice	.03	.01	1.03	.01
15. Reliance on instruction	-.29	.10	0.75	.002
20. Good driver after passing	.33	.13	1.39	.009

For young pupils who have undergone at least five hours of tuition it would be potentially useful to be able to compute a score that would indicate their likelihood of passing the test first time. For this purpose an index was calculated as follows:

TIND = PRACT/14+GOOD+6-RELY

where:

TIND = Test result index for novice drivers

PRACT = hours of practice

GOOD = rating of how good the driver would be after the test on a 5-point scale

RELY = rating of pupil's reliance on instruction on a 5-point scale

The index simply equalises the variance of the variables and reverses the scoring of the reliance variable to put all the variables on equal footing.

Drivers with a TIND score of 5 or less had a 33% chance of passing first time; those with a TIND score greater than 5 and less than or equal to 10 had a 59% chance of passing and those with a TIND score of more than 10 had a 75% chance of passing first time (χ^2=20.7, p<.001).

5 Results concerning six month follow-up

Of those that passed the test, 316 were successfully followed up at six months (response rate 79%). When completing the Pupil Questionnaire they reported that they had undergone an average 15.1 hours of tuition at the time of recruitment (SD=9.8), and 6.4 hours of practice (SD=10.1). When followed up they reported an average 26.2 hours of tuition up to their test (SD=14.9) and 18.0 hours of practice (SD=20.5). These figures were very similar to those found in 17 to 19 year-olds from the cohort study referred to earlier (Forsyth, 1992). The mean age of the final sample at the time of recruitment was 17.3 (SD=0.6). Forty-one percent were male. These figures for age and sex were similar to those for the original sample of 809 respondents.

Table 10 shows the basic descriptive statistics for the 6MFQ measures. The distribution of mileage post-test was very skewed yielding a high standard deviation. Only a small proportion admitted to having driven when they thought they might be over the legal alcohol limit (the DWI frequency measure).

Table 10 Descriptive statistics for measures taken at six month follow-up

	Male		Female	
	Mean	SD	Mean	SD
27. Mileage since test***	3121	3771.6	1457	1863.8
28. Ability to cope with traffic situations***	3.3	.49	3.1	.38
29. Speed compared with other drivers	2.9	.79	2.8	.63
30. Accident likelihood compared with other drivers***	2.4	.75	2.6	.58
31. Skill compared with other drivers***	3.4	.66	3.1	.51
32. Cautiousness compared with other drivers	3.6	.73	3.5	.62
33. DBQ violations***	20.6	6.3	16.9	4.2
34. DSQ speed***	10.1	3.4	8.3	3.3
35. DSQ calmness**	6.8	2.5	7.6	2.5
36. DWI***	1.1	.42	1.0	.07
37. Accidents**	.46	.80	.24	.56

*Note: * p<.05, **p<.01, *** p<.001 for comparison between males and females*

Males drove more miles, reported being better able to cope with traffic, less likely to have an accident compared with other drivers of the same age and sex, greater propensity to commit violations, greater tendency to speed, greater calmness, and more frequent drinking and driving. They also had significantly more accidents.

Table 11 shows correlations among measures in the six month follow up. Pupils with more hours of tuition prior to their test were more likely to report driving slowly and drove fewer miles. There were no associations between hours of tuition prior to the test or hours of practice prior to the test and accident involvement. DSQ speed and DBQ violations were highly correlated with each other and both were significantly correlated with number of accidents. DWI

Table 11 Correlations among measures at six-month follow up

	27	28	29	30	31	32	33	34	35	36
27. Mileage										
28. Ability to cope	.11									
29. Speed	.04	.11								
30. Accident likelihood	-.01	**-.17**	**.13**							
31. Skill	**.26**	**.12**	**.14**	**-.36**						
32. Cautiousness	.01	.02	**-.29**	**-.26**	**.14**					
33. DBQ violations	**.23**	.03	**.26**	.07	**.18**	**-.17**				
34. DSQ speed	**.21**	.07	**.39**	**.14**	**.16**	**-.22**	**.67**			
35. DSQ calmness	**-.27**	**-.33**	-.05	**.19**	**-.20**	-.06	**.12**	.08		
36. DWI	.04	-.09	-.01	.00	-.07	**-.13**	**.23**	**.14**	**.17**	
37. Accidents	**.17**	**-.12**	.07	**.15**	-.04	-.04	**.23**	**.17**	.05	**.16**

Note: correlations at or above .12 are significant at p<.05; correlations at or above .14 are significant at p<.01; correlations at or above .19 are significant at p<.001.

frequency was positively correlated with accidents and with DSQ speed and DBQ violations. Drivers high on DSQ speed and DBQ violations tended to drive more miles.

Table 12 shows correlations between measures in the Pupil Questionnaire and the six month follow up. SMQ deviance and attitudes to driving deviance were predictive of higher DSQ speed score, higher DBQ violation score, higher DWI frequency and higher accident frequency. Pupils who thought they would be good drivers and those who thought they would be safe drivers turned out to have fewer accidents at follow up.

Table 13 shows correlations between measures in the instructor checklist and the six-month follow up. Instructor ratings of pupils' current skill, and predicted safety were negatively correlated with number of accidents. Instructors' ratings of pupils' social responsibility and carefulness in decision making were also negatively related to accidents. Instructor ratings of pupils' future driving speed were correlated with driving DSQ speed and DBQ violations at follow-up.

It is important to control for mileage when assessing relationships between predictor variables and accidents. Table 14 shows the results of Poisson regression analyses of PQ variables with number of accidents controlling for mileage. A Poisson regression was used because accidents are more accurately modelled using this distribution than a normal distribution.

Table 15 shows results of Poisson regression analyses relating measures on the instructor checklist to number of accidents at six month follow-up with mileage controlled for. Instructors' views that the pupil would be a 'good' driver were most clearly related with accidents, as were their ratings of the pupil's current skill level (during training). Judgements of pupils' safety, social responsibility and carefulness in decision making were also related to accident rates.

Table 16 shows that DSQ speed, DSQ calmness, DBQ violations, and DWI frequency measured at follow-up were all related with accidents taking account of mileage.

Many of the items on the pupil questionnaire and on the instructor checklist were correlated with each other. In addition, accident rates are known to be higher for males than females -mainly because males drive considerably more miles per year than females. In the present study the accident rate was 0.46 for males and 0.24 for females, the difference remaining significant with mileage controlled for (p=.03 by Poisson regression).

To identify specific independent predictors of accident rates, stepwise Poisson regressions were carried out, first of all including just items on the pupil questionnaire and then including just items on the instructor checklist. Table 17 shows that the two measures from the PQ that came out as independent predictors were pupils' rating of how safe they would be in the future and the score representing their attitude to deviant driving. From the IC, the rating of whether the pupil would be a good driver in future was the only independent predictor of accident rates.

To assess whether the two pupil measures and one instructor measure would contribute independently towards prediction of accident rates, the three variables were entered together in a forced entry Poisson regression with mileage and sex controlled for. Table 18 shows that all three measures made independent contributions to predicting accident rates.

The three measures identified in Table 18 could be used for the practical goal of developing an index of future safety. Their standardised rate ratios were broadly similar so the simplest approach would be to add the scores of the

Table 12 Correlations between items in pupil questionnaire and six month follow up

	1 ski	2 con	3 enj	4 eas	5 pas	6 goo	7 saf	8 acc	9 att	10 tho	11 dev
27. Mileage	**.12**	**.20**	.07	.07	-.02	.03	-.02	.07	.09	-.05	.08
28. Ability to cope	**.18**	**.21**	**.13**	**.16**	.09	**.19**	.08	-.03	.01	.10	.00
29. Speed	**.13**	.09	.02	**.14**	.12	.07	.00	-.03	.06	.03	**.17**
30. Accident likelihood	**-.17**	-.04	-.04	**-.12**	-.10	**-.22**	-.12	.03	-.06	-.06	**.16**
31. Skill	**.18**	**.13**	.00	**.14**	.11	**.19**	.12	.01	.05	.02	.02
32. Cautiousness	**.12**	.02	.10	-.02	-.03	.07	.07	-.09	.01	**.13**	-.09
33. DBQ violations	-.01	.04	**-.17**	.01	.09	.00	**-.18**	.10	**.27**	-.03	**.40**
34. DSQ speed	-.03	.00	-.01	-.03	.06	.00	-.11	.06	**.30**	-.03	**.35**
35. DSQ calmness	**-.26**	**-.22**	-.07	**-.15**	-.10	**-.16**	**-.16**	.06	.05	**-.13**	-.09
36. DWI	-.04	-.06	-.07	-.05	.00	-.07	-.10	-.07	**.12**	-.06	.10
37. Accidents	-.09	-.07	.00	-.06	-.07	**-.15**	**-.20**	**.17**	**.18**	.04	**.15**

	Hours tuition	Hours practice
27. Mileage	**-.16**	.10
28. Ability to cope	**-.18**	-.01
29. Speed	-.06	-.11
30. Accident likelihood	**.18**	-.04
31. Skill	**-.20**	.00
32. Cautiousness	-.09	.05
33. DBQ violations	-.09	-.03
34. DSQ speed	-.08	-.01
35. DSQ calmness	**.17**	.08
36. DWI	.05	.01
37. Accidents	-.11	.05

Table 13 Correlations between items in instructor checklist and six month follow up questionnaire

	14 ski	15 rely	16 res	17 con	18 fee	19 fas	20 goo	21 acc	22 hig	23 eva	24 soc
27. Mileage	**.14**	-.07	.09	**.23**	.06	**.12**	.05	.06	**-.12**	-.08	**-.12**
28. Ability to cope	.01	-.10	.01	**.24**	.05	**.16**	.00	.03	.02	.03	-.04
29. Speed	.00	.02	-.03	.03	.01	.06	.01	-.04	-.05	-.02	**-.15**
30. Accident likelihood	-.11	.11	-.07	-.10	-.06	-.04	-.08	.04	-.02	-.03	-.01
31. Skill	**.13**	**-.13**	**.12**	.11	**.14**	.08	.11	-.02	.08	.00	-.07
32. Cautiousness	.06	.01	.03	.05	.03	.01	.08	-.08	.09	.04	**.12**
33. DBQ violations	.03	.01	.01	**.17**	-.04	**.16**	-.07	.13	-.09	-.08	**-.14**
34. DSQ speed	-.03	.08	-.01	.07	-.07	**.20**	-.07	.14	-.11	-.09	**-.14**
35. DSQ calmness	-.10	.06	-.01	**-.15**	**-.12**	-.03	-.02	-.01	.01	-.03	.04
36. DWI	-.08	.03	-.03	-.04	-.02	.01	-.04	.08	-.05	.01	.01
37. Accidents	**-.12**	.09	-.04	.00	-.09	-.04	**-.12**	.09	-.09	-.08	-.10

Table 14 Results of Poisson regression analyses relating pupil questionnaire to accident rates controlling for mileage

	Rate ratio	Significance level
1. Mean current skill rating	0.69	ns
2. Confidence while driving	0.72	ns
3. Enjoyment of driving lessons	0.69	ns
4. Ease of learning to drive	0.65	.05
5. Chances of passing test	0.94	ns
6. How good will be after test	0.50	.002
7. How safe will be after test	0.48	<.001
8. Chances of accident in first year after test	1.43	.05
9. ADVS attitude	0.89	<.001
10. DMQ thoroughness	0.97	ns
11. SMQ deviance	1.10	<.001
12. Hours of tuition	1.00	ns
13. Hours of practice	1.00	ns

Note: In this and subsequent tables, rate ratios are used as the index of association. These show the change in accident rate for each unit increase in the predictor variable. Thus a rate ratio of 2 indicates that for every unit increase in the predictor variable there is a doubling in accident rate; a rate ratio of 0.5 indicates a halving of the accident rate with every unit increase in predictor variable.

Table 15 Results of Poisson regression analyses relating instructor checklist with accident rates controlling for mileage

	Rate ratio	Significance level
14. Mean current skill rating	0.64	.02
15. Pupil's reliance on instruction	1.28	.03
16. Pupil's responsiveness to instruction	0.83	ns
17. Pupil's confidence in driving ability	0.80	ns
18. How safe feel with pupil	0.81	ns
19. How fast pupil will be after test	0.82	ns
20. How good a driver pupil will be after test	0.60	<.001
21. Pupil's likelihood of accident	1.19	ns
22. How attentive to highway code pupil will be	0.86	ns
23. How careful pupil is in evaluating	0.77	.05
24. How socially responsible pupil is	0.76	.03

Table 16 Results of Poisson regression analyses relating follow-up questionnaire items with accident rates (average number in 6 months) controlling for mileage

	Rate ratio	Significance level
28. Ability to cope	0.54	.01
29. Speed	1.22	ns
30. Accident likelihood	1.76	<.001
31. Skill	0.76	ns
32. Cautiousness	0.79	ns
33. DBQ violations	1.07	<.001
34. DSQ speed	1.08	.02
35. DSQ calmness	1.09	.03
36. DWI	2.17	<.001

Table 17 Results of stepwise Poisson regression of measures taken during driver training on accidents with mileage and sex controlled for

	Rate ratio	Significance level
Pupil questionnaire:		
How safe will be in future	0.53	<.001
Positive attitude to driving deviance	0.91	.001
Instructor checklist:		
Pupil will be good driver in future	0.62	.001

Table 18 Forced entry Poisson regression of measures taken during driver training on accidents with mileage and sex controlled for

	Rate ratio	Significance level
Rating by P of how safe will be in future	0.50	<.001
P's attitude to driving deviance	0.93	.02
Instructor rating of how good a driver P will be	0.64	.004

three measures after making an adjustment to equalise the range of values and to reverse the scoring of measures that had a negative association with accidents. This produces the following formula:

SIND $= (4-\text{SAFE})+(6-\text{GOOD})/1.5+\text{ATT}/7$

SIND   is Safety Index for Novice Drivers

SAFE   is Pupil rating of how safe they will be
       (3-point scale)

GOOD   is Instructor rating of how good pupil will be
       (5-point scale)

ATT   is Attitude to driving deviance (sum of ratings
       on 7-item questionnaire)

Figure 9 shows the mean accident rates of drivers in each quartile of this index. It is clear that there is a simple linear function relating the index to accident rates. Drivers in the highest quartile averaged five times the accident rate of those in the lowest quartile. There was a suggestion that the relationship was stronger for men than women although in both cases it was statistically significant. There was a suggestion of a dip in the accident risk for males in the third quartile.
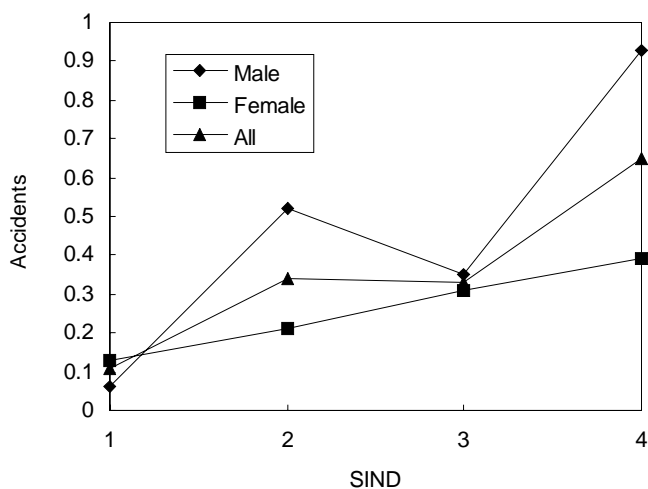
Figure 9 Mean accident rates for drivers in each quartile of SIND score. The increase in accident rate for males and females separately was significant at p<.002 and p<.01 respectively by Mantel-Haenszel test.

Focusing on the instructor ratings, although the overall rating of whether the pupil would be a 'good' driver in the future was clearly useful from a practical point of view, it was not clear how far this reflected adjudged driving skill or other aspects of the pupil's behaviour. The fact that this overall rating was correlated with both skill and other ratings suggests that both were involved. To obtain a clearer idea of the specific role of skill in accidents we examined the association between the instructors' ratings of pupil skill and accidents taking account of the other measures (social responsibility, predicted speed, predicted attentiveness to the

highway code, and carefulness in decision making). A forced entry Poisson regression involving the mean skill rating and ratings of carefulness in decision making, social responsibility, and predicted attentiveness to the highway code with mileage and sex added as covariates showed a significant independent negative association between skill ratings and accident rates (rate ratio=0.94, p<.02).

This leaves open the question of what component or components of skill might be important. In order to identify individual skill components that may be related to accidents we carried out a Poisson regression relating individual skill items with accident involvement taking account of sex and mileage. The results show that anticipating hazards and spotting potential hazards quickly were related to accidents, as was keeping a safe distance from the vehicle in front (Table 19).

Table 19 Results of Poisson regression analyses relating individual components of driving skill to accident rates taking account of sex and mileage

Item	Rate ratio	Significance
Judging the width of the car while driving	.90	ns
Keeping within a 30 mph speed limit	.88	ns
Keeping up with the flow of traffic	.83	ns
Correctly positioning the car for a right turn	.88	ns
Carrying out a left turn without hitting the kerb	.69	.03
Judging the speed of other vehicles	.68	ns
Anticipating hazards	.53	.001
Spotting potential hazards quickly	.61	.005
Adjusting to slippery road conditions	.67	.04
Stopping in an emergency	.82	.ns
Approaching a junction at a speed appropriate to the road layout	.70	.04
Positioning the vehicle correctly when approaching a roundabout	.82	ns
Keeping a safe distance from the vehicle in front	.67	.01

Note: The sample size for this analysis was reduced to 152 which was the number of pupils for whom every one of the ratings was considered applicable by the instructor. Pupils who had not performed a particular manoeuvre were not given a rating for that item.

A stepwise Poisson regression revealed that once ability to anticipate hazards was entered into the equation, no other specific skill ratings added to the prediction of accidents.

Turning to relationships between variables measured at follow-up and accident rates, Table 20 shows the results of a stepwise regression onto accident rates. Drivers who felt less able to cope were more likely to commit driving violations, were more likely to drive when they thought they might be over the limit, and had more accidents.

Table 20 Results of stepwise Poisson regression of measures at six months on to accidents controlling for mileage and sex

	Rate ratio	Significance level
28. Ability to cope	0.44	<.001
33. DBQ violations	1.05	.002
36. DWI	1.53	.05

6 Results concerning 12 month follow-up

Table 21 shows the Cronbach alpha coefficients obtained at the 12 month follow-up and re-test reliability correlations for the multi-item scales. The DBQ and DSQ re-test reliability coefficients were based on comparisons between 12 month scores and those taken at the 6 month follow-up. The SMQ and ADVS reliability coefficients were based on comparisons between 12 month scores and measures taken at baseline (i.e. during driver training).

Table 21 Psychometric properties of multi-item scales used at 12 month follow-up

	Alpha	Re-test reliability
DBQ violations	.79	.70***
DSQ speed	.74	.72***
SMQ deviance	.76	.56***
ADVS attitude	.70	.54***

Descriptive statistics on variables measured at 12 month follow-up are given in Table 22. It is clear that the males in the sample drove more miles, scored higher on tendency to commit driving violations, had a more positive attitude to driving deviance, scored higher on social deviance, drove faster over the year since passing the test and had more accidents. None of the women in the sample reported having been charged with a moving traffic offence and there were no endorsements recorded. By contrast nearly 1 in 10 of the men reported having been charged with a moving traffic offence and more than 1 in 20 had endorsements already recorded on their licences.

Table 22 Descriptive statistics on variables measured at 12 month follow-up

	Male		Female	
	Mean	SD	Mean	SD
38. Miles driven**	7297	7510	4849	5674
39. Driving offences (DVLA)**	6.3%		0%	
40. Driving offences (self report)**	8.8%		0%	
41. Speed on open road**	51.6	10.9	48.1	8.0
42. Speed on motorway***	74.3	8.7	69.8	7.1
43. Speed on urban road	35.1	5.8	34.1	5.2
44. DBQ violations***	21.3	6.9	18.2	5.1
45. DSQ speed***	10.9	3.4	9.2	3.4
46. SMQ Deviance*	15.9	3.8	14.1	3.2
47. ADVS attitude**	12.3	4.6	10.8	3.6
48. Accidents over 12 months*	.59	.94	.39	.60

*Difference between males and females * p<.05 **p<.01 ***p<.001.*

It is apparent from Table 22 that the accident rates across the full year were not double those measured at 6 months (0.59 versus 0.46 for males and 0.39 versus 0.24 for females). Mileage driven on the other hand was more than double that covered in the first six months (7297 versus 3121 for males and 4849 versus 1457 for females). It is possible that part of the difference was due to respondents forgetting about accidents that had occurred in

the first six months. However, at the one year follow up, drivers were also asked to report again accidents that had occurred in the first six months and this revealed no evidence of accidents having been forgotten when compared with the six month follow-up data. It appears therefore that there was a marked reduction in reported accident rates taking account of miles driven from the first to the second six months of driving.

Table 23 shows Spearman correlations among variables measured at 12 months. Accident rates were positively correlated with mileage, DBQ violations, DSQ speed, SMQ deviance, ADVS attitude to deviant driving and licence endorsements.

Self-reports of being charged with a moving traffic offence correlated to quite a high degree with endorsements. The correlation would not be expected to be unity because not all those having been charged would have been convicted by the time of the check on DVLA records. Behavioural deviance measures correlated moderately with each other and with attitudes to driving and general social deviance. Higher mileage drivers tended to be more deviant in their driving behaviour and attitudes, but were not more socially deviant.

Table 24 shows correlations between measures taken during driver training and those taken at 12 months. DBQ violations, and various speed measures were predicted by prior attitudes to driving deviance and general social deviance. Accidents over 12 months were negatively correlated with confidence while learning, prediction of being a good driver and prediction of being a safe driver. They were also negatively associated with thoroughness in decision making and positively correlated with attitude to driving deviance and general social deviance.

Pupils with more tuition went on to drive fewer miles, and were less likely to report driving fast and committing driving violations.

Table 25 shows that instructors' predictions of pupils' tendency to drive fast, accident risk and attentiveness to the highway code were related to tendency to commit violations and to drive fast reported in the 12 month follow-up. Accident risk at 12 months was related to instructors' predictions of accident liability and attentiveness to the highway code.

To assess the relationship between baseline measures and accident rates taking account of miles driven a series of Poisson regression analyses were carried out, one for each baseline variable. Of the PQ variables, less enjoyment of lessons, predictions of being less good a driver and less safe a driver were related to accident rates (Table 26). Positive attitude to driving violations and general social deviance were positively related to accident risk. Of the IC variables, ratings of pupils' carefulness in decision making and social responsibility, prediction of pupils' accident risk, and attentiveness to the highway code were related to accident risk taking account of mileage (Table 27).

Table 28 shows the results of a Poisson regression in which sex and mileage were entered and then variables from the PQ added until none added significantly to the predictive power of the regression. Social deviance and attitude to deviant driving were both independently related to accident rates.

Table 23 Spearman correlations between variables measured at 12 months

	38	39	40	41	42	43	44	45	46	47
38. Miles driven										
39. Driving offences (DVLA)	.12									
40. Driving offences (self report)	.07	**.59**								
41. Speed on open road	.11	.08	.08							
42. Speed on motorway	**.18**	.03	.12	**.30**						
43. Speed on urban road	.03	.04	.08	**.19**	**.36**					
44. DBQ violations	**.22**	.06	.10	**.30**	**.40**	**.37**				
45. DSQ speed	**.24**	-.03	.02	**.30**	**.64**	**.49**	**.65**			
46. SMQ Deviance	.10	.11	.09	.07	**.25**	**.20**	**.49**	**.39**		
47. ADVS attitude	**-.18**	**-.17**	-.12	**-.32**	**-.39**	**-.31**	**-.53**	**-.50**	**-.32**	
48. Accidents over 12 months	**.20**	.07	**.15**	.04	**.23**	.11	**.26**	**.29**	**.20**	**-.23**

Note: correlations of ≥.13 p<.05; ≥.17 p<.01; ≥.20 p<.001

Table 24 Spearman correlations between measures in the Pupil Questionnaire and those taken at 12 months

	1 ski	2 con	3 enj	4 eas	5 pas	6 goo	7 saf	8 acc	9 att	10 tho	11 dev
38. Miles driven	.09	**.14**	.03	-.01	-.03	.05	.00	-.02	.10	-.04	.08
39. Driving offences (DVLA)	.00	-.02	-.04	-.09	.01	.05	-.02	.02	-.05	.00	.07
40. Driving offences (self report)	.05	-.01	-.04	.01	.08	.02	-.03	.05	.04	-.07	.09
41. Speed on open road	.03	.00	-.06	.03	.05	.05	-.05	.11	**.22**	.09	.08
42. Speed on motorway	.04	-.03	-.01	.01	-.03	.02	.06	.04	**.22**	-.01	**.24**
43. Speed on urban road	**-.19**	-.05	-.03	-.03	.08	-.06	-.04	**.13**	**.15**	.03	**.20**
44. DBQ violations	.01	-.02	-.11	.06	.04	.03	-.11	.12	**.28**	.04	**.41**
45. DSQ speed	.00	-.03	-.06	.02	.04	.02	-.08	.09	**.31**	-.05	**.35**
46. SMQ deviance	.03	-.03	-.11	.09	.03	-.04	-.10	**.13**	**.15**	-.06	**.56**
47. ADVS attitude	.05	.10	-.12	.07	.07	.12	-.12	.04	**.54**	-.01	**.31**
48. Accidents over 12 months	-.12	**-.15**	-.12	-.08	-.01	**-.15**	**-.17**	.09	**.20**	**-.14**	**.22**

	Hours of tuition	Hours of practice
38. Miles driven	**-.14**	.03
39. Driving offences (DVLA)	-.12	.01
40. Driving offences (self report)	-.11	.02
41. Speed on open road	**-.13**	.02
42. Speed on motorway	**-.16**	**.17**
43. Speed on urban road	-.10	-.05
44. DBQ violations	**-.19**	.03
45. DSQ speed	**-.16**	.02
46. SMQ deviance	-.07	-.06
47. ADVS attitude	-.09	.01
48. Accidents over 12 months	.05	.07

Table 25 Spearman correlations between measures in the Instructor Checklist and those taken at 12 months

	1 ski	2 rel	3 res	4 con	5 fee	6 fas	7 goo	8 acc	9 hig	10 eva	11 soc
38. Miles driven	.05	.01	-.04	**.15**	-.05	**.13**	.01	.12	**-.19**	**-.15**	**-.21**
39. Driving offences (DVLA)	.05	-.11	-.08	.03	-.07	.09	-.08	.01	-.12	-.10	**-.14**
40. Driving offences (self report)	.00	-.10	**-.15**	.04	-.03	.08	-.07	.04	-.12	**-.17**	**-.13**
41. Speed on open road	-.03	.07	-.04	-.03	-.04	.10	-.08	.12	**-.16**	-.03	-.12
42. Speed on motorway	-.09	.04	-.12	.03	.02	.09	-.11	**.18**	-.11	-.08	**-.18**
43. Speed on urban road	-.10	-.04	-.08	.04	-.06	.12	-.08	.11	-.08	-.07	.00
44. DBQ violations	-.03	.00	-.03	**.13**	-.06	**.24**	-.09	**.27**	**-.13**	-.09	**-.19**
45. DSQ speed	**-.13**	.03	-.08	.04	-.11	**.22**	-.14	**.27**	**-.19**	-.08	**-.20**
46. SMQ deviance	-.04	-.12	-.06	.07	-.03	.11	.03	.06	-.04	-.01	-.08
47. ADVS attitude	-.05	.04	-.05	**.17**	-.10	**.19**	-.07	**.22**	**-.13**	-.09	-.09
48. Accidents over 12 months	-.08	.10	-.08	-.01	-.09	.10	-.06	**.20**	**-.14**	-.10	-.12

Table 26   Results of Poisson regression between accidents at 12 months and PQ measures controlling for mileage

	Rate ratio	Significance level
1. Mean current skill rating	0.82	ns
2. Confidence while driving	0.67	ns
3. Enjoyment of driving lessons	0.64	.009
4. Ease of learning to drive	0.86	ns
5. Chances of passing test	1.12	ns
6. How good will be after test	0.62	.01
7. How safe will be after test	0.62	.003
8. Chances of accident in first year after test	1.16	ns
9. ADVS attitude	1.10	<.001
10. DMQ thoroughness	0.95	ns
11. SMQ deviance	1.07	.005
12. Hours of tuition	1.01	ns
13. Hours of practice	1.01	ns

Table 27 Results of Poisson regression between accidents at 12 months and IC measures controlling for mileage

	Rate ratio	Significance level
14. Mean current skill rating	0.87	ns
15. Pupil's reliance on instruction	1.20	ns
16. Pupil's responsiveness to instruction	0.85	ns
17. Pupil's confidence in driving ability	0.95	ns
18. How safe feel with pupil	0.84	ns
19. How fast pupil will be after test	1.15	ns
20. How good a driver pupil will be after test	0.81	ns
21. Pupil's likelihood of accident	1.38	.003
22. How attentive to highway code pupil will be	0.72	.01
23. How careful pupil is in evaluating	0.78	.04
24. How socially responsible pupil is	0.80	.03

Table 28   Results of stepwise Poisson regression using variables from PQ controlling for sex and mileage

	Rate ratio	Significance level
9. ADVS attitude	1.06	<.001
11. SMQ deviance	1.06	.002

Deviance=230, df=235.

At six month follow-up, attitude to driving deviance and prediction of driving safety had been shown to predict accident rates using a regression method similar to that shown in Table 28. Table 29 shows that putting sex, mileage, attitude to driving deviance, and predicted safety in forced entry regression predicting 12 month accident rates yielded very similar predictive power to the model arrived at in Table 28. Thus there was nothing to choose between the regression model optimised for prediction of the 12 month accident rates and the one derived from prediction of the six month accident rates.

Table 29   Results of Poisson regression using PQ predictors of accidents identified in six month follow-up, controlling for sex and mileage

	Rate ratio	Significance level
9. ADVS attitude	1.08	<.001
7. How safe will be	0.69	.02

Deviance=229, df=234

A Poisson regression analysis was carried out with mileage and sex entered and then variables from the IC predicting accident rates at 12 months. As with the PQ variables, IC variables were added to the model until there was no significant improvement in model fit. Table 30 shows that only instructors' prediction of pupils' future accident risk was related to accidents.

Table 30   Results of stepwise Poisson regression of IC predictors on to accidents controlling for mileage and sex

	Rate ratio	Significance level
21. Likelihood of accident	1.35	.005

Deviance=247, df=234

Table 31 shows the results of a Poisson regression in which PQ variables identified as independent predictors of accident rates and the IC variable predictive of accident rates were entered together with sex and mileage controlled for. It is clear that all the variables made significant independent contributions to accident prediction.

Table 31   Results of forced entry Poisson regression of IC and PQ predictors on to accidents controlling for mileage and sex

	Rate ratio	Significance level
9. ADVS attitude	0.92	.002
11. SMQ deviance	0.70	.03
21. Likelihood of accident	1.27	.03

Table 32 shows the results of a forced entry Poisson regression in which all the variables in the Safety Index for Novice Drivers, derived using the six month accident rates, were entered and sex and mileage controlled for. As would be expected, only the PQ variables in the index made independent contributions to predicting accident rates.

Figure 10 shows the mean 12 month accident rates for quartiles of SIND score derived from the six month accident data. The SIND score was divided into quartiles based on pupils who completed the baseline questionnaires. There was a significant increase from the lowest to the highest quartile, with a suggestion of a dip in the third quartile.

Table 32 Results of forced entry Poisson regression of 6 month IC and PQ predictors on to accidents controlling for mileage and sex

		Rate ratio	*Significance level*
7.	How safe	0.69	.02
9.	ADVS attitude	0.92	.001
20.	How good will be	0.85	ns
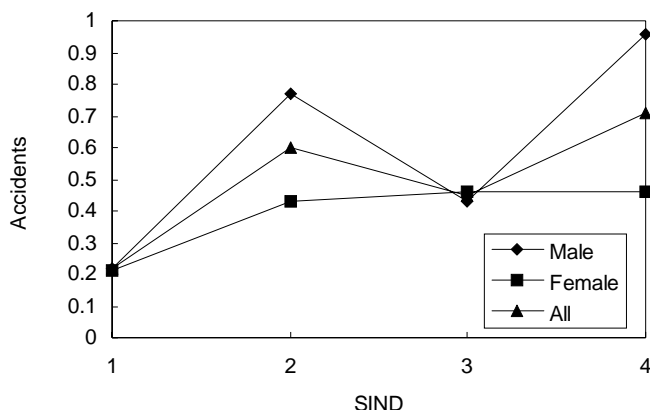
Figure 10 Relationship between SIND score and 12 month accident rates. p<.05 for both males and females by Mantel-Haenszel

Figure 11 shows mean accident rates for drivers in each quartile of a revised SIND score (SIND2) optimised for prediction of 12 month data using the preceding regression results. The score was calculated as follows:
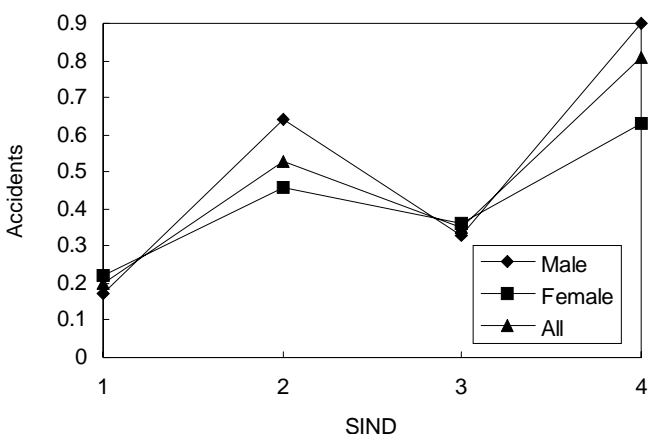
SIND2 = DEV/7+ATT/7+ACCID/2

where:

DEV   is the social motivation deviance score measured in the PQ

ATT   is the attitude to driving deviance score measured in the PQ

ACCID is the instructors' rating of pupils' future accident risk measured in the IC.

Figure 11 Mean accident rates for revised SIND score (SIND2) optimised for prediction of 12 month accident figures. p<.05 by Mantel-Haenszel

Drivers in the highest quartile had approximately four times the accident rate of those in the lowest quartile. There was evidence of dip in the third quartile.

Table 33 shows the results of a series of Poisson regressions in which variables measured at 12 month follow-up were related to accident rates controlling for mileage. It is clear that all except for DVLA recorded driving offences were related to accidents.

Table 33 Results of Poisson regression of variables measured at 12 months on to accidents controlling for mileage

		Rate ratio	*Significance level*
39.	Driving offences (DVLA)	1.08	ns
40.	Driving offences (self report)	1.94	.01
41.	Speed on open road	1.03	.003
42.	Speed on motorway	1.04	<.001
43.	Speed on urban road	1.04	.01
44.	DBQ violations	1.05	<.001
45.	DSQ speed	1.14	<.001
46.	SMQ deviance	1.09	<.001
47.	ADVS attitude	1.09	<.001

A Poisson regression was carried out with sex and mileage entered, then variables measured at 12 months entered one at a time until there was no further improvement to the fit of the model. Table 34 shows that tendency to commit driving violations and positive attitude to driving violations were independently predictive of accidents and that no other variables added further to prediction of accidents.

Table 34 Results of stepwise Poisson regression of variables measured at 12 months on to accidents controlling for mileage and sex

		Rate ratio	*Significance level*
44.	DBQ violations	1.06	<.001
45.	ADVS attitude	1.03	<.001

7 Discussion

7.1 Prediction of accident rates

The results provide the first evidence to our knowledge that novice drivers' accident risk can be predicted from measures taken during driver training. The practical implications of this are profound. If high risk drivers can be identified early in training, special steps can be taken to attempt to reduce this risk. Clearly there is no guarantee that attempts to reduce the accident rates of high risk drivers will be successful but these results provide a starting point for the search.

Examination of the main variables that predicted accident rates may suggest possible ways forward. Considering first of all the pupil's own rating of his or her safety, the surprising thing is that pupils have an insight into the fact that they will be unsafe. Such awareness could form the basis for an

educational intervention, asking them what specific aspects of their driving they would consider as problematic and what they feel about the prospect of having an accident. The aim could be to use their own self-awareness as the starting point for an agreed remedial programme involving both attitudinal and skill-based training.

Turning to the attitude score, it is clear that attitudes to deviant driving stem from personal characteristics that pre-date acquisition of a full driving licence. In particular it is worth noting the relationship with the broader characteristic of social deviance. This implies that it may not be sufficient to focus exclusively on attitudes in the driving context. Instead it may be necessary to examine the pupil's broader social values and attempt to reposition his or her perception of driving within these. In particular, trying to persuade a pupil with little regard for conventional social norms or the welfare of others that they should be more responsible in the way they drive is unlikely to be effective. A more fruitful approach may be to try to get them to identify safe driving practices with a feeling of self-worth and competence in a domain in which they can come to believe they outperform other members of society. Thus one might attempt to encourage anti-social drivers to express their misanthropy in terms of being 'better' drivers than the 'crowd', where better is redefined in terms of calm professionalism rather than selfishness and aggression.

Considering finally the instructor ratings, these appear to support the idea that in the first six months at least, driving skill is an important element of accident risk. However, the dividing line between skill and performance is not always clear and some of the individual skill ratings may be construed as relating to driving style (e.g. ability to keep a safe distance from the vehicle in front). Nevertheless, it is apparent that components of skill as diverse as hazard perception and correct positioning of the vehicle were predictive of accidents with hazard anticipation emerging as a particularly important focus for training.

An obvious point that arises from the present results is whether the safety index developed here could be used to screen out unsafe drivers, perhaps as part of a 'theory test'. The common sense answer is that it almost certainly could not, as it would be too easy for pupils to 'fake good'. Any self-report or instructor-based measure would be subject to the same limitation. On the other hand, it may be possible for driving examiners to be trained to focus on aspects of driving during the test that are more predictive of future safety. Those aspects could be identified by examining the relationships between ratings made by examiners and criterion variables identified in research as predictive of accident risk. This could be a fruitful avenue for future research.

7.2 Prediction of performance in the driving test

Instructors are able in principle to predict test outcome. Ratings of reliance on instruction and how good the driver would be after the test were independently related to subsequent test outcome. These two variables, together with practice undertaken prior to taking the measures, were able to discriminate between drivers with a poor chance of passing the test first time (33%) and drivers with a very

good chance (75%). As a practical tool, this could provide the first step towards more targeted instruction geared towards raising the pass rates. As yet, it is not clear what form this targeted instruction might take. The next section discusses what role informal practice might play in improving skill development. In the context of formal tuition one possible target may be to find ways of encouraging the pupil to be more self-reliant. This could be achieved by raising the threshold for intervening as long as this could be done without jeopardising safety.

There was little evidence that variables related to driver safety were also related to test outcome. For example, test outcome was not a function of social deviance or pupils' attitude to driving deviance. This confirms the widely held view that the current driving test is primarily a test of low level (or perhaps vehicle handling) skills, and also reflects the impracticability of assessing motivational or attitudinal variables in the test situation. There are two important caveats, however. First of all, it appears that in the first six months of driving, aspects of driving skill may well contribute to accident risk. Instructors' judgements of pupils' driving skill and how good a driver the pupil would be were related to accidents in the first six months. Secondly, instructors' ratings of pupils' likelihood of accident were in fact related to accident rates in the 12 months following the test. This implies that there is something observable in the pupils' behaviour that gives a clue to accident liability. Whether this could be picked up in the short time available during the driving test remains to be demonstrated.

7.3 The role of tuition and practice in learning to drive

The results indicate that instructors' ratings of pupil skill increased with pupils' prior experience of practice and with increasing tuition among those with no practice. Instructors felt safer with pupils with more practice, but not pupils with more tuition. Instructors rated pupils with more practice as more responsive to instruction, while pupils with more tuition were rated as less responsive. Pupils with more practice were judged more likely to pass the test, while those with more tuition were judged less likely. Pupils' own assessments of their driving skill were positively associated with prior hours of tuition but not practice. However, pupils with higher levels of tuition rated learning to drive as harder and less enjoyable than those with lower levels of tuition.

The results suggest that informal practice has a positive effect in the acquisition of driving skill as adjudged by an instructor, while the extent of formal tuition above 6-10 hours has an important effect among pupils with no other practice. The study enables no conclusions to be drawn about whether 6-10 hours of formal tuition has an effect compared with none at all, although the findings of Forsyth (1992) suggest that this is the case. It should be noted, however, that only about 4% of male and 1% of female learners have less than six hours of formal tuition before taking their test (Forsyth, 1992).

The relationship between practice and skill level cannot be attributed to the fact that inherently skilful drivers who are confident and enjoy driving are more likely to have higher levels of practice, because there was no association

between pupils' ratings of confidence or enjoyment of driving and amount of practice. Thus it seems likely that the higher levels of practice are causing an increase in skill. However, this would need to be confirmed by a prospective study or an experimental study in which a random sample of learners who would not normally undertake practice are offered varying amounts of supervised practice. If this finding were confirmed it would have important implications concerning the place of formal tuition and supervised practice, as well as informing individual choices about whether or not to undertake practice. It may also be that driving schools could offer a form of supervised practice that would be different from conventional lessons for pupils who would not wish or would not be able to find friends or relatives to practise with.

It is interesting that there was a negative relationship between instructors' judgements of the likelihood of pupils passing the test and prior hours of tuition. In fact this judgement turns out to reflect the true situation (Forsyth, 1992). The basis for the judgement is unclear. It may be a function of the fact that except in the case of pupils with no practice, there is little detectable improvement in skill levels with increasing tuition. A relatively low level of skill after many hours of tuition might signal to an instructor an inherent lack of ability to learn to drive whereas the same level of skill after only a few lessons may not be interpreted in that way.

The disparity between pupils' and instructors' judgements of pupils' level of skill and confidence was striking. Pupils with less practice did not appear to be less confident or judge their skill levels to be lower even though their instructors clearly rated them as such. It seems reasonable to assume that the instructors' judgements were more accurate in that they were able to draw on experience with other pupils when forming their opinions and had themselves received training in the process of instruction. It appears therefore, that pupils are poor judges of their own skill and their own progress. In fact, there was a general tendency for pupils to overestimate their skill level compared with ratings made by their instructors. This is consistent with a general tendency for drivers to overestimate their driving ability (Groeger and Brown, 1989; McCormick, Walkey and Green, 1986; Svenson, 1981), although to our knowledge this is the first time it has been demonstrated in learner drivers. Failure of pupils accurately to perceive the level of driving ability could lead them to put in for the driving test before they were ready. Any overestimation of their ability could subsequently have implications for their accident risk. These issues will need to be taken up in further research.

The fact that pupils with higher levels of tuition were judged to be less likely to pass their test, enjoyed driving less and found it harder, particularly in the highest tuition category, is consistent with the view that pupils lacking in inherent ability to learn to drive are over-represented in groups receiving large amounts of tuition. One would expect more than 50% of males and 29% of females to take their test with fewer than 25 hours of tuition (Forsyth, 1992). However, it remains a possibility that the experience of learning to drive becomes less enjoyable over time. This is something that needs to be examined

further. If this turns out to be the case it would be worth examining what aspects of the tuition process might be having this effect.

Considering the process of learning to drive as an example of skill acquisition, the fact that tuition was shown to be effective among learners not undergoing practice and that practice appeared to be less effective among pupils with large amounts of tuition suggests a common learning pathway following the well-known decelerating learning curve. However, there was a significant correlation between practice and instructors' skill ratings among pupils with more than five hours of both practice and tuition (r=0.21, p<.001), while there was no significant correlation between tuition and skill among the same group of pupils (r=0.07, ns), which suggests that among pupils with at least a minimal level of tuition practice may produce a steeper learning curve than tuition. This makes it imperative to examine in detail the process of learning to drive to determine why this should be. One possibility is that once the initial learning phase is over and basic driving skills have been acquired, practice may accelerate learning by helping learners to take responsibility for solving problems that may arise from traffic situations. It may be difficult for an instructor to refrain from providing guidance even though more rapid learning would occur if the pupil were to be given more latitude. This is an issue that requires further investigation.

7.4 Other issues

Associations between accidents and measures taken after the driving test including: driving violations, driving speed, attitude to driving violations and social deviance confirm the robustness of previous findings. These relationships are now among the best-established in the field of accident liability. It is of interest that the attitude measure was related to accident rates over and above tendency to commit driving violations. This suggests that accident risk involves a broader approach to risk and more general risky behaviours than are encompassed by the driving violations measure. The results also provide clear support for the idea that accident risk stems in part from personality factors that go beyond the driving situation.

The decrease in accident rates from the first to the second six months was striking. This is the first study to have examined the issue prospectively. Other studies had asked about accidents after one year and used the reported dates of the accidents to attempt to draw conclusions about rates at different points in the year. Although it is possible in principle that the present findings could be due in part to drivers questioned at 12 months having forgotten about accidents that occurred in the first six months, thereby deflating the 12 month figure, in practice an examination of the dates given for accidents reported over the 12 months indicates no evidence of such forgetting. This finding indicates that by far the most dangerous period for novice drivers is in the first six months following the test. It does not support the view put forward elsewhere that the first few months of driving represent a 'honeymoon' period in which caution balances inexperience so that the greatest accident risk occurs later when drivers begin to gain confidence.

7.5 Methodological considerations

Several factors could limit the generalisability of the findings. First of all, the study only involved learner drivers under the age of 20 years. Previous research has shown that older drivers are less likely to pass the driving test (Forsyth, 1992) and may have particular reasons for having delayed taking lessons. Therefore, it was felt better to restrict the sample to young learners to make the process of interpretation easier. In fact a majority of people in the UK take their first driving test before the age of 20, but further research may be needed to examine how the present findings generalise to older age groups.

Secondly, the instructors were volunteers and may be expected to be more conscientious and better at making the required judgements than average. It remains to be seen how well the instructor rating part of the safety index would perform in widespread use. On the other hand it is worth noting that no training was given to the instructors in making the ratings and perhaps a small amount of training could improve their ability to detect potentially unsafe drivers.

Thirdly, the pupils were volunteers and this may limit the range of some of the variables, especially those relating to social deviance. Any range restriction would, if anything, be expected to militate against finding relationships among the variables so the estimates of the size of relationships are probably conservative.

A fourth limitation is the use of self-report or, in the case of the instructors, observer-report measures. There are some areas where self-reports can be shown to be reliable and valid and others where they are more suspect. In general, one would expect self-reports to be biased in favour of presentation of a positive image. Therefore it is all the more remarkable that measures such as social deviance were found to relate to accidents at follow-up. One possible reason for this is that people who are high in social deviance see nothing wrong with their orientation and make no effort to disguise it. Thus some of the measures used may tap both attitudes and the propensity to express those attitudes in questionnaires. In the case of the instructor ratings, it may be argued that these have limited validity and reliability. However, if this were so the large error variance would work against finding associations with other variables such as accident rates. It may also be noted that the instructor ratings were predictive of driving test outcome, so there was some correspondence between instructors' ratings of the pupils and the opinions of independent driving examiners.

Fifthly, all the learners in the sample had had at least five hours of tuition. This was because it was felt that instructors would need a certain period of acquaintance with the learners in order to be able to make judgements about them. However, it means that no conclusions can be drawn about the very early stages of learning to drive when, according to Forsyth (1992), formal tuition may have its greatest impact. Prospective studies would be required in order to track the development of driving skills in this early period.

8 Conclusions

This study has demonstrated that measures taken during driver training can predict accident rates following the driving test. Although it is unlikely that these measures could be used to screen out unsafe drivers because of the possibility to 'fake good', they do offer the possibility of enabling pupils and instructors to identify the pupils' level of risk and could be used as part of the process of driver training. The measures shown to relate to future accident risk, including pupils' attitude to deviant driving and prediction of future safety, and instructors' ratings of pupils' future driving ability and accident risk, could provide a focus for such training.

The study also found that it was possible to gain an indication of whether or not the pupil would pass the driving test at the first attempt. Instructors in particular appeared to have access to information that would enable a prediction to be made. There was little evidence for overlap between pupil characteristics that were related to test outcome and those that were related to accident risk. Thus there was little to suggest that the present driving test was examining characteristics that would be relevant to safety beyond basic driving skill. However, the fact that instructors could make reasonably accurate predictions about pupils' future safety suggests that there may be scope in the future for directing examiners' attention to cues that would be more diagnostic of safety.

The results also provided evidence that both practice and tuition can play an important role in acquiring driving skills. Formal tuition beyond five weeks appeared to be effective in pupils in this sample with no practice, while practice appeared to be helpful in pupils with varying amounts of tuition. It will be important to confirm these findings with prospective studies so that recommendations can be made concerning the use of practice in the process of learning to drive, and possibly having driving schools offering supervised practice as an additional form of training.

Relationships between accidents and attitudes to driving deviance, social deviance, self-reported driving speed and self-reported commission of driving violations can now be considered among the most robust findings in the literature, and the fact that social deviance is related to accident risk and deviant driving indicates the importance of broad personality characteristics in this domain.

The findings that accident rates decreased from the first to the second six months following the driving test emphasises the role of inexperience and the rapidity of the change in risk that occurs once the driving test has been passed. This in turn highlights the importance of attempting to accelerate this process and ensure that as much learning as possible occurs before the test is taken.

9 Acknowledgements

10 References

Ackerman P L (1987). *Individual differences in skill learning: an integration of psychometric and information processing perspectives*. Psychological Bulletin, 102(1), 3-27.

Ackerman P L (1992). *Predicting individual differences in complex skill acquisition: dynamics of ability determinants*. Journal of Applied Psychology, 77(5), 598-614.

Brown I D (1992). *The case for long-term care in driver training*. Paper presented at 'New Perspectives on Integrated Traffic Training in Europe'. Best, The Netherlands.

Duncan J, Williams P and Brown I D (1991). *Experience does not mean expertise*. Ergonomics, 34, 919-937.

Elander J, West R and French D (1993). *Behavioral correlates of individual differences in road traffic crash risk: an examination of methods and findings.* Psychological Bulletin, 113, 279-294.

Fabiani M, Buckley J, Gratton G and Coles M G (1989). *The training of complex task performance. Special Issue: The Learning Strategies Program: an Examination of the Strategies of Skill Acquisition*. Acta Psychologica, 71, 259-299.

Forsyth E (1992). *Cohort study of learner and novice drivers Part 1: Learning to drive and performance in the driving test.* Research Report RR338. Transport Research Laboratory, Crowthorne.

Groeger J A and Clegg B (1994). *Why isn't driver training contributing more to road safety?* In G.B. Grayson (Ed.) Behavioural Research in Road Safety IV. PA3035/94 Transport Research Laboratory, Crowthorne.

Groeger J A and Brown I D (1989). *Assessing one's own and others' driving ability: influences of sex, age, and experience*. Accident Analysis and Prevention, 21(2), 155-168.

Horneman C (1993). *Driver Education and Training: a Review of the Literature*. Driver Education Unit, Roads and Traffic Authority, Armidale NSW, Australia.

Karl K A, O'Leary-Kelly A M, and Martocchio J J (1993). *The impact of feedback and self-efficacy on performance in training*. Journal of Organisational Behavior, 14, 379-394.

Lester J (1996). *A survey of Department of Transport approved driving instructors*. TRL Report TRL151. Transport Research Laboratory, Crowthorne.

Logan G D (1988). *Towards an instance theory of automatization*. Psychological Review 95, 492-527.

Macdonald W (1987). *Driving Performance Measures and Licence Tests: a Review of the Literature*. Federal Office of Road Safety, Canberra.

Maycock G, Lockwood C and Lester J (1991). *The accident liability of car drivers*. Research Report RR315. Transport Research Laboratory, Crowthorne.

McCormick I A, Walkey F H and Green D E (1986). *Comparative perceptions of driver ability - a confirmation and expansion*. Accident Analysis and Prevention, 18, 205-208.

McKenna F and Crick J (1993). *A cognitive-psychological approach to driver training: the use of video technology in developing the hazard perception skills of novice drivers*. In G.B. Grayson (Ed.) Behavioural Research in Road Safety III. PA3004/93 Transport Research Laboratory, Crowthorne.

Newell K M (1985). *Co-ordination, control and skill*. In Differing Perspective in Motor Learning, Memory and Control. Elsevier, Amsterdam.

Newell K M (1991). *Motor skill acquisition*. Annual Review of Psychology, 42, 213-238.

Parker D, West R, Stradling S and Manstead A (1994). *Behavioural characteristics and involvement in different types of traffic accident*. Accident Analysis and Prevention, 27, 571-581.

Quimby A, Downing C and Callahan C (1991). *Road users' attitudes to some road safety and transportation issues*. Contractor Report CR227. Transport Research Laboratory, Crowthorne.

Quimby A R, Maycock G, Carter I D, Dixon R and Wall J G (1986). *Perceptual abilities of accident-involved drivers*. Research Report RR27. Transport Research Laboratory, Crowthorne.

Reason J, Manstead A, Stradling S, Parker D and Baxter J (1991). *The social and cognitive determinants of aberrant driving behaviour*. Contractor Report CR253. Transport Research Laboratory, Crowthorne.

Svenson O (1981). *Are we less risky and more skillful than our fellow drivers?* Acta Psychologica, 47, 143-148.

Welford A T (1968). *Fundamentals of Skill*. Methuen, London.

Welford A T (1976). *Skilled Performance: Perceptual and Motor Skills*. Glenview, Illinois.

West R (1994). *Why do people drive fast: the role of personality and attitudes*. In D. Arp (Ed.) Slowing the Speedy Driver: Proceedings of the RoSPA Annual Conference on Road Safety. Royal Society for the Prevention of Accidents, Birmingham.

West R (1997a). *Accident script analysis*. TRL Report TRL274. Transport Research Laboratory, Crowthorne.

West R (1997b). *Cross-cultural generalisability of relationship between anti-social motivation and traffic accident risk*. TRL Report TRL294. Transport Research Laboratory, Crowthorne.

West R, Elander J and French D (1992). *Decision making, personality and driving style as correlates of individual accident risk*. Contractor Report CR309. Transport Research Laboratory, Crowthorne.

West R, Elander J and French D (1993). *Mild social deviance, Type-A behaviour pattern and decision-making style as predictors of self-reported driving style and traffic accident risk*. British Journal of Psychology, 84, 207-219.

West R and Hall J (1997). *The role of personality and attitudes in traffic accident risk*. Applied Psychology: An International Review, 47, 253-264.

Winstein C J and Schmidt R A (1990). *Reduced frequency of knowledge of results enhances motor skill learning*. Journal of Experimental Psychology: Learning, Memory and Cognition, 16, 677-691.

Abstract

Measures taken during driver training were used to predict subsequent driving test outcome and accident liability in the year following the test in a sample of 809 young learner drivers. Pupils' assessment of their skill, and instructor ratings of pupils' skill, responsiveness to instruction, confidence, safety, how good a driver pupils would be after the test, how careful pupils were in their decision making, and hours of practice predicted likelihood of passing the test. Pupils' general social deviance and specific attitude to driving deviance while learning to drive, and instructors' ratings of pupils' likelihood of an accident following the test predicted accident rates six months and 12 months after the test, controlling for mileage. There was no evidence that more confident drivers were at greater risk of accident. Accident rates controlling for mileage were substantially lower in the second six months following the test than in the first six months. The results indicate that high risk drivers can be identified during driver training. There is only a small degree of overlap between factors associated with accident risk and factors associated with likelihood of passing the driving test.

Related publications

TRL294   Cross-cultural generalisability of relationship between anti-social motivation and traffic accident risk by R West. 1998 (price code A, £15)

TRL275   Cohort study of learner and novice drivers – Part 4 by G Maycock and E Forsyth. 1997 (price code H, £30)

TRL274   Accident script analysis by R West. 1997 (price code E, £20)

TRL151   A survey of Department of Transport Approved Driving Instructors by J Lester. 1996 (price code E, £20)

PR111   Cohort study of learner and novice drivers, Part 3: Accidents, offences and driving experience in the first three years of driving by E Forsyth, G Maycock and B Sexton. 1995 (price code J, £35)

RR338   Cohort study of learner and novice drivers, Part 1: Learning to drive and performance in the driving test by E Forsyth. 1992 (price code H, £30)

CR309   Decision making, personality and driving style as correlates of individual accident risk by R West, J Elander and D French. 1992 (price code N, £45)

RR372   Cohort study of learner and novice drivers, Part 2: Attitudes, opinions and the development of driving skills in the first 2 years by E Forsyth. 1992 (price code H, £30)

RR315   The accident liability of car drivers by G Maycock, C R Lockwood and J F Lester. 1991 (price code C, £15)

CR227   Road users' attitudes to some road safety and transportation issues by A Quimby, C Downing and C Callahan. 1991 (price code D, £18)

CR253   The social and cognitive determinants of aberrant driving behaviour by J T Reason, A S R Manstead, S G Stradling, D Parker and J S Baxter. 1991 (price code E, £20)

RR27   Perceptual abilities of accident involved drivers by   A R Quimby, G Maycock, I D Carter, R Dixon and J G Wall. 1986 (price code C, £15)

Prices current at May 1998

For further details of these and all other TRL publications, telephone Publication Sales on 01344 770783 or 770784, or visit TRL on the Internet at http://www.trl.co.uk.