A cluster Randomised Controlled Trial (cRCT) evaluation of the DriveFit pre-driver education programme using the Theory of Planned Behaviour

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Abstract

Road traffic injuries are the leading of cause of death of 15-29 year olds worldwide (World Health Organisation, 2017), making young driver safety a global public health concern. Pre-driver road safety education programmes are popular and commonly delivered with the aim of improving safety amongst this at risk group, but have rarely been found to be effective (Kinnear et al., 2013). This research designs and evaluates, via a cluster Randomised Controlled Trial (cRCT) a pre-driver education intervention (DriveFit) using the Theory of Planned Behaviour (TPB) (Ajzen, 1991). The responses of 16–18-year-old students (n = 434) from 22 schools in Devon, UK were analysed as part of the research. The study results found that the DriveFit intervention led to some small improvements in risk intentions, attitudes, and other measures, which diminished over time and differed by sub-group. The findings of this study substantially add to the limited evidence on pre-driver road safety education effectiveness.

Keywords

Young driver; Pre-drivers; Road Safety Education; Behaviour Change Techniques; Theory of Planned Behaviour

Introduction

Young driver safety is a global public health concern. Worldwide, road traffic injuries are the leading cause of death for 15-29 year olds, making up 13% of all fatalities within this age group (World Health Organisation, 2017). In the UK, 24% of KSI collisions involve a young driver, even though 17-24 year olds account for a much smaller percentage – 7% - of all licence holders (RAC Foundation, 2020).

Educational interventions aimed at improving young driver safety have, to date, heavily focused on increasing awareness and knowledge of risk taking behaviours, which has not been found to lead to lasting behavioural change (Raftery and Wundersitz, 2011; Mayhew et al., 2014), in part due to the recognised 'intention-behaviour' gap (Fylan, 2017; Senserrick and Kinnear, 2017). Training and education interventions have not typically been developed with a theoretical underpinning; and have instead often taken a short-term and a one-size fits all approach to content development (Pressley et al, 2016). Fear appeal interventions, often delivered through testimonial performances, are widespread and controversial. Increasingly positive emotional appeals are being recommended for use, which have been found to be more effective than fear appeals in increasing the relevance of and engagement with risk information (Cutello et al., 2020) and reducing risky driving behaviours, particularly amongst high risk drivers (Lewis et al., 2008). The present study builds on this accumulated body of knowledge by designing a new pre-driver intervention (DriveFit), with reference to behavioural science and intervention effectiveness literature, and evaluating its effects in a novel way using a cluster Randomised Controlled Trial research design.

No previous research within the traffic psychology discipline has used a high quality research design to evaluate the effects of a positively framed educational intervention on pre-driver behavioural intentions using the Theory of Planned Behaviour (TPB) (Ajzen, 1991), and this research seeks to fill this gap.

The primary aim of the study was to empirically evaluate a newly designed 'DriveFit' school-based road safety education programme for its effectiveness of increasing positive road safety intentions amongst 16–18-year-old pre-drivers and newly qualified drivers, immediately post intervention and 8-10 weeks post intervention. The effect of the programme on intentions was chosen as the primary outcome measure given that intention is the most proximal determinant of human social behaviour within the TPB (Ajzen, 1991). The effect of the intervention on secondary outcomes of self-reported socio-cognitive measures (attitudes, subjective norms, and perceived behavioural control), perception of risk, attitudes towards driving violations, efficacy and driver coping was also assessed.

Methods

To evaluate the DriveFit programme, a school/college-based cluster randomised controlled trial (cRCT) was conducted within government-funded, non-free paying (state), all-ability, co-educational schools/colleges in Devon, UK. Fifty-six schools/colleges were sent a recruitment letter in July 2021, with details of how to take part in the trial. Following recruitment, baseline measurements were taken in September 2021, after which schools/colleges were randomly allocated, using a stratified random sampling approach (based on school type and deprivation levels) to one of two conditions: (1) to deliver the DriveFit intervention to year 12 and/or 13 students (up to 3 classes / 90 students in each school /college) or (2) no-treatment wait list control group. The delivery of the DriveFit intervention took place in schools/colleges between Nov 21 – Jan 22. Participating schools and colleges were offered a £200 cash incentive for taking part. The protocol for the trial was developed and delivered in accordance with CONSORT 2010 guidelines[1] and Standard Protocol Items: Recommendations for Intervention Trials (SPIRIT) guidance[2] and the study was retrospectively registered with the ISRCTN (ISRCTN71350920)[3]. Ethical approval for the study was gained from the Cranfield University Research Ethics Committee (CURES/3733/2018). Data collection was supported by national level partners.

Participant self-report survey data was collected at baseline (T1), immediately after (T2) and 8 - 10 weeks after intervention delivery (T3). The components of the TPB were measured using standardised questions from the literature (Conner and Sparks, 2005; Rowe et al., 2016). Perception of risk, (Glendon et al., 2014; Ivers et al., 2009) attitudes towards driving violations (ADVS) (West and Hall, 1997), efficacy (Ford et al., 1998) and driver coping strategies (Matthews et al., 1996) were also measured. The questionnaire contained items measuring intentions and attitudes towards risk-taking activities including hand-held mobile phone use whilst driving, driving over the legal alcohol limit, driving whilst feeling very tired and driving over the speed limit (See Table A1, Annex). Students were also asked socio-demographic questions (gender, age, ethnicity), as well as questions about their learning to drive stage, driving practice experience and the number of cars in their household. A process evaluation was also conducted to examine the action model for the intervention. All data was collected and managed in line with GDPR requirements.

[1] http://www.consort-statement.org/consort-2010
[2] https://www.spirit-statement.org/registry/
[3] https://www.isrctn.com/ISRCTN71350920

The DriveFit programme consisted of a 40-minute film[4] shown in classrooms followed by a 45-minute online facilitated workshop within 2 weeks of watching the film. The film was designed with reference to the TPB (Ajzen, 1991) and Behaviour Change Techniques (BCTs) (Michie et al., 2013) and used a positively framed talk show format in the development of the script. Expert guests provided information, demonstrations, and tips about how pre, learner and newly qualified drivers can manage the learning to drive process as well as speeding, tiredness, mobile phone use and intoxicated driving. The online facilitated workshop used the ORID framework / Focused Conversation Method (ICA-UK, 2014) to encourage students to remember the film and extract relevant learning for their own personal situations. Students were introduced to setting implementation intentions (if-then plans)[5] (Gollwitzer, 1999; Gollwitzer and Sheeran, 2006; Sheeran and Orbell, 1999; Webb and Sheeran, 2006), and invited to commit to these using DriveFit postcards to take away at the end of the session. A website (www.drivefit.info) supported the programme by providing additional road safety information to students, parents, and guardians.

The primary efficacy outcome, intention, was compared between intervention and control groups using a General Estimating Equation (GEE) model, with adjustments made for baseline Intentions. A working correlation matrix was specified to model for the correlation between individuals within school/college clusters. An estimate of the intervention effect, 95% CI and p value was then calculated. A similar method was used for secondary outcomes. The GEE model applied used Gamma with log link to account for the positively skewed data, with parameters included for condition (i.e. control and Drivefit), baseline outcome, gender, age, driving stage, ethnicity, education type, school level disadvantage, number of cars in the household and time between survey completion.

Results

Descriptives

A total of 2030 students from 32 schools returned a questionnaire at baseline (T1). Following survey matching across the study period, valid data was collected for 434 students (Control: n = 209, DriveFit: n = 225). A two-way ANOVA was conducted to assess whether there was any difference in the responses at baseline for those students that had responded at all timepoints. The results show that for four items (see Table 1 below) there was a statistically significant difference between the survey responses received at baseline by those participants who only completed the baseline survey (Baseline only) and those who completed the surveys for all measurement periods (T1_T3). This indicates that respondents who completed the survey at all measurement periods, had safer views on some measures, in comparison to those who discontinued involvement in the study at baseline.

Table 1: Significant two-way ANOVA and pairwise comparison results

Measure*	Baseline only (*SE*) (I)	T1_T3 (*SE*) (J)	Mean score diff (I-J)	95% CI	*F*	*p*	Partial η^2
INT_ALL	1.87 (.024)	1.77 (.043)	.100	[.004, .197]	4.171	.041	.002
INT_MOB	1.53 (.026)	1.42 (.046)	.110	[.007, .213]	4.372	.037	.002
INT_ALCO	1.15 (.014)	1.09 (.025)	.029	[.000, .114]	3.796	.052	.002
PBC1_SPEED	2.29 (.050)	2.01 (.086)	.275	[.079, .471]	7.591	.006	.004

*Note: df 1,1785 * See Table A1, Annex for measure details.*

[4] https://vimeo.com/637484469/d13965f81a
[5] https://drivefit.info/wp-content/uploads/2021/10/DriveFit-guide-for-developing-Safe-Drive-Plans.pdf

Chi-square tests for association were also conducted to determine whether there was any difference in the proportion of socio-demographic categorical variables for 1) control respondents at baseline only and T3; 2) intervention respondents at baseline only and T3; 3) T3 responses for control and intervention groups (See Table 2).

Table 2: Chi square tests of association for categorical variables

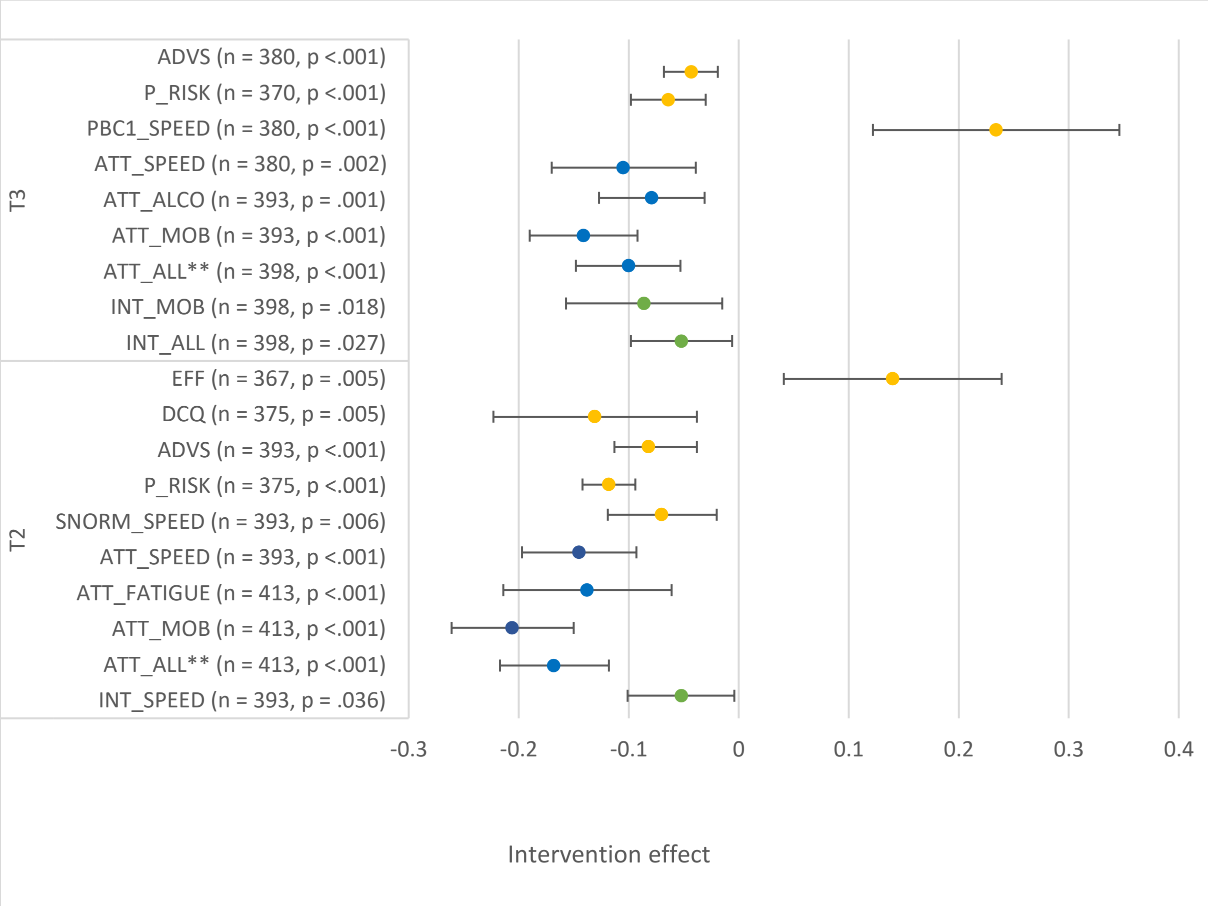
Group	Condition 1	Condition 2	Variable	Chi-Square results
Control	Baseline only	Valid T3 responses	Driving stage	X^2 (2, 985) = 19.45, p = <.001
			Number of household cars	X^2 (2, 983) = 7.78, p = .02
			Education type	X^2 (1, 1007) = 10.97, p <.001
			Disadvantage level	X^2 (1, 1007) = 4.34, p = .037
Intervention	Baseline only	Valid T3 responses	Gender	X^2 (1, 828) = 7.92, p = .005
			Education type	X^2 (1, 863) = 17.03, p <.001
			Disadvantage level	X^2 (1, 863) = 25.54, p <.001
T3 responses	Control	Intervention	Gender	X^2 (1, 425) = 7.57, p = .006
			Number of household cars	X^2 (2, 437) = 10.82, p = .004
			education type	X^2 (1, 437) = 4.69, p = .030
			disadvantage level	X^2 (1, 437) = 50.19, p <.001

Collectively the chi-square goodness of fit tests shows that there were some differences in group characteristics, with some sub-groups not as well represented within the final T3 data analysis. However, the GEE analysis method controls for socio-demographic factors and considers any variation in the sample characteristics.

GEE results

The GEE model outputs (See Figure 1) show that DriveFit had a very small positive effect on speed intentions immediately after delivery, when compared to the control condition, and a similar order of effect on a composite measure of all intentions as well as mobile phone intentions 8-10 weeks post-delivery. The intervention speed intentions effect at T2 (Intervention vs control difference: B = -.052 with CI -.101, -.004, p = .036) only equates to a 1/20th of a scale point improvement in speed intentions. The effect of DriveFit on attitudes, was greater than intentions at both timepoints, although these effects diminished in magnitude over time. DriveFit had the greatest effect on mobile phone attitudes and the composite measure of all attitudes. Of the other measures assessed, DriveFit also had a positive immediate effect on (in order of magnitude) perception of risk, driving coping scores, attitudes towards driving violations and speeding social norms. These positive intervention effects remained at the 8-10 weeks stage for perception of risk and attitudes to driving violations measures, although, as with the other measures, the effects diminished in their magnitude over time.

Figure 1: Intervention effect of DriveFit at T2 and T3, presented as baseline adjusted intervention vs control differences *B* (95% CI)*



** All measures were scaled so that lower numbers represented safer responses. Intervention effects below 0 represent a positive effect of the DriveFit intervention (over and above control, once socio-demographic factors controlled for). Responses above 0 represent a negative effect of the intervention. Only measures where there was an effect of the intervention are displayed in Figure 1. Of the 16 measures analysed (See: Table A1, Annex), the DriveFit intervention had an effect on 10 (63%) at T2 and 9 (56%) at T3.*

*** ATT_ALL represents a composite measure of all risk behaviour attitudes, minus ALCO_ATT, due to floor effects for responses to this measure.*

Sub-group analysis revealed that positive effects of the DriveFit programme varied by sub-group for certain measures and time periods. Overall, females reported safer intentions and attitudes than males (e.g. INT_FATIGUE_T3, Female: *B* = -.150 with CI -.246, -.054, *p* = .002) irrespective of being in the control or intervention group and positive effects of the DriveFit intervention were found more frequently and at a greater magnitude for females than males (e.g. ATT_MOB_T2, Female: *B* = -.238 with CI -.303, -.174, *p* <.001; Male: *B* = -.136 with CI -.212, -.060, *p* <.001). School students frequently reported safer intentions (e.g. INT_ALL_T3, School: *B* = -.135 with CI -.170, -.099, *p* <.001) and attitudes (e.g. ATT_MOB_T3, School: *B* = -.105 with CI -.173, -.037, *p* = .003) than college students and whilst there was, overall, no differential effect of DriveFit on intentions by education type, a differential positive effect for school students was seen for some of the other measures (e.g. ATT_FATIGUE_T2, School: *B* = -.120 with CI -.185, -.056, *p* <.001). The DriveFit intervention had a negative impact on two measures: efficacy, immediately post intervention (*B* = .14 with CI .041, .239, *p* = .005) and speeding perceived behavioural control, 8-10 weeks post intervention (*B* = .234 with CI .122, .346, *p* <.001) (See Figure 1).

Effect modification analysis by sub-group found that the negative road safety impact of the intervention on personal efficacy was for males (B = .234 with CI .052, .416, p = .012) and those from above median disadvantage educational settings (B = .237 with CI .043, .430, p = .017). The negative road safety impact of the intervention on perceived behavioural control for speeding was also apparent for males (B = .312 with CI .104, .519, p = .003) and those from above median disadvantage educational settings (B = .525 with CI .439, .612, p = <.001) as well as college students (B = .137 with CI .005, .269, p = .042). Both of these measures were one item only, rather than scales (See Table A1, Annex), which might in part explain this result.

Discussion and conclusions

Study results are in line with previous research showing that education interventions deliver small self-reported effects, that diminish over time (Poulter and McKenna, 2010) with differential affects by gender and educational setting (Cuenen et al., 2016). One of the difficulties of drawing firm conclusions from these findings are that there are known limitations associated with self-reported methods (Hessing et al., 1988) including poor reliability (Af Wåhlberg and Dorn, 2015), socially desireable responding and common method variance (Wåhlberg et al., 2010). Behavioural methods to evaluate the impact of educational interventions amongst young people have used in-vehicle data recorders (Tapp et al., 2013) but this approach would have excluded pre-drivers from the present research and led to practical difficulties.

A limitation of the study is that, despite a purposive sampling of schools with varied socioeconomic status, it is likely that participants may not be entirely representative of the wider population in the UK. Further, due to issues with recruitment and retention of individuals across the surveys, the final sample size used in the analysis is somewhat small. As a result, the statistical power of the analysis to detect an effect is reduced and there is a higher risk of concluding that the intervention does not make a difference to young driver intentions, when it does (i.e., Type II error). With a larger sample size and more power, the study may have been able to detect more significant effects.

The presence of intervention effects at 8-10 weeks post intervention illustrates that delivering educational programmes, may have a limited beneficial effect. However, it is not known what specific features of the intervention (i.e. film or workshop) had an impact on the results. The follow-up workshops were facilitated online, and this format may not have had the same impact on intentions and attitudes compared with that of a classroom-based in-person group discussion. Further work is required to ascertain whether there is an effect of different delivery formats. It is also possible that the duration of the intervention period was not sufficient to change intentions and attitudes. Future research may need to investigate the effect of different intervention delivery periods. It is likely that short term interventions will have a less pronounced effect on pre-driver intentions and attitudes.

The novelty for the present research is the design of a positively framed intervention programme underpinned by the Theory of Planned Behaviour (Ajzen, 1991) and Behaviour Change Techniques (Michie et al., 2013). Further work is required to develop DriveFit, perhaps by incorporating this component of the intervention alongside classroom-based workshops and follow-up positively framed messages to motivate safe behaviour post-licensure.

Funding: This study has been funded by the UK Department for Transport, the Road Safety Trust, National Fire Chiefs Council, RAC Foundation, Road Safety GB and Kent Fire and Rescue Service. Devon and Somerset Fire and Rescue Service supported the delivery of the DriveFit trial. For further information about the project, please visit the project website[6].

[6] https://www.racfoundation.org/collaborations/pre-driver-theatre-workshop-education-research-pdtwer

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Annex

A1: Survey instrument measure details

Measure	Acronym	No. items	Scale	Question
Primary outcome measures				
All intentions (Excluding alcohol)	INT_ALL	8	1:7	[Scaled mean of INT_MOB, INT_FATIGUE & INT_SPEED) [Likely – Unlikely] [Very willing – Not at all willing]
Mobile phone use intentions	INT_MOB	2	1:7	How likely and willing would you be to drive whilst messaging or talking on a hand-held mobile phone
Drink driving intentions	INT_ALCO	2	1:7	How likely and willing would you be to drive whilst over the legal alcohol limit
Driving whilst fatigued intentions	INT_FATIGUE	2	1:7	How likely and willing would you be to drive whilst feeling very tired
Speeding intentions	INT_SPEED	2	1:7	How likely and willing would you be to drive over the speed limit
Secondary outcome measures				
All attitudes (Excluding alcohol)	ATT_ALL	16	1:7	[Scaled mean of ATT_MOB, ATT_FATIGUE, ATT_SPEED) [Harmful – Beneficial], [Negative – Positive] [Wise – Foolish], [Pleasant-Unpleasant]
Mobile phone use attitudes	ATT_MOB	4	1:7	Driving whilst messaging or talking on a hand-held mobile is…
Drink driving attitudes	ATT_ALCO	4	1:7	Driving whilst over the legal alcohol limit is…
Driving whilst fatigued attitudes	ATT_FATIGUE	4	1:7	Driving whilst very tired is…
Speeding attitudes	ATT_SPEED	4	1:7	Driving over the speed limit is…
Additional secondary outcome measures				
Social norms associated with speeding	SNORM_SPEED	2	1:7	People who are important to me [think that I should/should not] / [would approve/disapprove of me] drive/ing over the speed limit [Think I should – Think I should not] [Would approve – would disapprove]

Measure	Acronym	No. items	Scale	Question
Additional secondary outcome measures cont...				
Perceived behavioural control associated with speeding	PBC1_SPEED	1	1:7	How much control would you have over whether or not you would driver over the speed limit [Complete control – No control]
Attitudes to Driving Violations Scale	ADVS	7	1:5	To what extent do you agree or disagree with the following statements…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 driver 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 20mph; Penalties for speeding should be more severe [Strongly agree, Agree, Neither agree nor disagree, Disagree, Strongly disagree]
Perception of risk scale	P_RISK	10	1:4	When driving, how safe do you think the following situations are…Driving with 2 or more passengers; Driving between midnight and 6am; Driving at 70mph in a 60mph zone; Driving at 40mph in a 30mph zone; Driving while talking on a mobile phone; Driving a car which is over 10 years old; Driving with a blood alcohol level just over the legal limit; Driving whilst messaging on a mobile phone; Driving after smoking marijuana; Going through a red light. [Always safe, Mostly safe, Sometimes safe, Rarely Safe]
Driver coping questionnaire scale	DCQ	4	1:6	Think of a particularly stressful driving situation, such as having a collision, being stuck in a traffic jam or having to drive for a long time in poor visibility and heavy traffic. How much do you think you would engage in the following activities when driving is difficult, stressful or upsetting...I will make sure I avoid reckless or impulsive actions; I will make sure I keep a safe distance from the vehicle in front; I will make sure that I deliberately slow down when I meet a difficult traffic situation or bad weather; I will make sure I watch my speed carefully [Not at all – Very much]
Efficacy	EFF	1	1:5	To what extent do you agree or disagree with the following statement: As a driver, I am confident that I will meet the challenge of maintaining safe driving behaviours and managing my personal risk whilst driving [Strongly agree – Strongly disagree]

Note: For all scale measures, a Cronbach's alpha of 0.65 or higher was considered satisfactory for data clustering (Field, 2013).