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Evaluation of eco-driving training for vehicle fuel use and emission reduction: A case study in Australia

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ABSTRACT

This study evaluates effectiveness of driver education teaching greater fuel efficiency (Eco-Driving) in a real world setting in Australia. The driving behaviour, measured in fuel use (litres per 100 km of travel) of a sample of 1056 private drivers was monitored over seven months. 853 drivers received education in eco-driving techniques and 203 were monitored as a control group. A simple experimental design was applied comparing the pre and post training fuel use of the treated sample compared to a control sample. This study found the driver education led to a statistically significant reduction in fuel use of 4.6% or 0.51 litres per 100 km compared to the control group.

Introduction

Eco-driving is a way of driving designed to reduce fuel consumption. It is based on a group of behaviours including a person's driving style, the way the vehicle is used, how often it is used, the configuration of the car and accessories such as roof racks, how and when luggage is carried, and day-to-day and longer-term vehicle maintenance.

Eco-driving is part of a comprehensive approach to reducing the transport sector's contribution to Greenhouse Gas (GHG) emissions. In 2009 road passenger transport in Australia was responsible for emissions equivalent to 41.5 million tonnes of CO_2, or 7.6% of total national emissions (Department of Climate Change and Energy Efficiency, 2011).

Wengraf (2012) in a meta-analysis of 25 eco-drive related studies concluded that by applying eco-driving techniques a car driver could reduce fuel use by approximately 10%. This is supported by the ITF/OECD Workshop on eco-driving (held in Paris in November 2007) where delegates stated that Ecodriving has the potential to reduce CO_2 surface transport emissions by 10% (ITF et al., 2007) and by de Haan (2008) who quantified some specific effects of individual strategies and their fuel reduction potential. For example, de Haan (2008) stated that gentle acceleration and engine braking can reduce fuel use by 11% and 2% respectively; and a 'sporty' driving style increases fuel use by 20%. These individual strategies and their effects on fuel consumption were incorporated in the curriculum of the eco-driving training reported upon in this study.

The benefits of eco-driving have been extensively studied in the heavy vehicle sector. The Cleanrun Behaviour Change Initiative (Department of Environment and Conservation, WA, 2008) investigated the benefits of eco-driving training in this area. This initiative was trialled with Toll Ipec (an Australian express freight company) and used a community-based social marketing approach. Linfox (an Australian logistics company) implemented a program to reduce CO_2 emissions across the organisation, of which 80% is transport-fuel related (Department of Resources, Energy and Tourism, 2012). The Linfox

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program included coaching and mentoring in eco-drive competencies that had been integrated into the company's performance management system. The company reduced its CO_2 emissions by 14% (Linfox, 2012).

As the aim of the training was to change driving habits, the motivations supporting individuals to drive in certain ways and the importance of educational strategies that tap into those motivations needed to be accommodated in the curriculum. Two key behaviour change theories were used in developing the training: the theory of planned behaviour (Ajzen, 1985; Hardeman et al., 2002); and behavioural economics (New Economics Foundation, 2005; Jackson, 2005).

This study addresses the lack of empirical evidence within the private vehicle fleet and whether drivers will change their behaviour to drive efficiently once they have learnt the strategies. The fuel use of 1056 drivers was monitored for up to seven months. The drivers were trained in one of five eco-driving training interventions or were monitored as a control group. The average fuel use relative to the control was compared pre and post the eco-driving training. When the fuel use fell it was assumed that the training was successful.

Methods

A simple experimental design was employed to assess the effectiveness of five eco-driving training interventions to reduce fuel use.

Effectiveness was measured by comparing the change in fuel use before and after the participants received the training. Fuel use was measured for six weeks prior to training and twelve weeks after training.

The training interventions were developed after a review of the literature on existing programs and behaviour change theories. The Cleanrun Behaviour Change Initiative (Department of Environment and Conservation, WA, 2008) and the Linfox program, and publications such as Symmons et al. (2009), de Haan (2008), and Wengraf (2012), were considered.

The theory of planned behaviour seeks to understand the link between behaviour and attitudes. According to the theory, attitudes to behaviour, subjective norms and perceived behavioural controls are all functions of behavioural beliefs. Originally proposed by Ajzen (1985) it argues that an individual is more likely to adopt a new behaviour if they perceive it positively (they have a positive attitude to a behavioural belief); they think others around them want them to adopt the behaviour (normative to a subjective norm); and they believe it is possible to overcome the barriers to success (perceived behavioural controls). According to Azjen, this intention to act is critical to behaviour change (Ajzen, 1985; Hardeman et al., 2002)

The theory of planned behaviour was used to measure and influence drivers' normative beliefs about speeding to support the development of road safety initiatives. Cameron et al. (1993) presented an example of a television advertisement campaign produced by the Victorian Traffic Accident Commission, in which drivers sought to influence the behaviour of their peers. Consequently, the training developed for this study attempted to influence individual participants' views on possible motivations for change (i.e., reduced costs, stress, improved safety and reduced GHG emissions). Other aspects were incorporated into the education tools to support behaviour change.

Behavioural economics also looks at motivators for behaviour change and particularly how they relate to peers and other people in the social context of the individual driver. This is important when looking at behaviour such as driving in a social context (New Economics Foundation, 2005). They argue that to change a habit a person needs to feel she/he has the capacity or skills to make the change; that others around them will value that new behaviour and that while they are loss-averse and bad at computation, they want to do the perceived right thing.

Jackson (2005) argues that for individuals, habits on consumption are often 'locked in' behaviours that are influenced by cultural norms and what others do. Understanding of the role of social and moral norms therefore requires logical goal-oriented action. This incorporates awareness at one level (e.g., I will behave in pro-social ways when I understand the consequences of my actions) and a social motivation (I will do this because that is what my social group believes and does). For the development of an education program, Jackson argues that a concerted approach is required that engages with people, makes behaviour change easy and incorporates incentives and rules that enable access to good choices.

A training curriculum was developed focusing on the following strategies:

- Monitoring fuel use
- Watch ahead and drive smoothly
- Brake and accelerate gently
- Use the right gear for the conditions
- Shift through the gears as quickly as possible
- Don't park and idle
- Maintain a steady cruise speed on highways – use cruise control where appropriate
- Minimise air conditioner use
- Maintain tyre pressure – keep your tyres inflated to the maximum level
- Remove excess weight and reduce aerodynamic drag – take off the roof racks
- Service your car to the manufacturer's schedule

These were packaged into a range of delivery mediums resulting in five training interventions, as follows:

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