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Cognitive training interventions to improve young drivers' speed management behaviour: Effects, implications, and perspectives

Oleksandra Molloy *, Brett R.C. Molesworth, Ann Williamson

School of Aviation, University of New South Wales, Sydney, NSW, Australia

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1. Introduction

Road related fatalities are a global problem. Every year it is estimated that 1.24 million people die as a result of road crashes (World Health Organization (WHO), 2013). Speeding is a leading factor contributing to these road crashes (World Health Organization, 2013). In New South Wales, Australia, excess speed is thought to be responsible for approximately 40% of fatal motor vehicle crashes (New South Wales (NSW) Centre for Road Safety, 2013). Young and inexperienced drivers between the age of 17–24 years are overrepresented in the road fatalities, and remain at higher risk of crashing comparing to their older counterparts (Bureau of Infrastructure, Transport and Regional Economics – Bureau of Infrastructure & Regional Economics (BITRE), 2013, Chen et al., 2009; Williamson, 2003). Speed management remains an elusive skill for many young drivers (Clarke, Ward, Bartle, & Truman, 2006).

Young drivers tend to underestimate the risk associated with speeding (McKenna & Horswill, 2006). As a result, they are less likely to adhere to the speed limit and/or adjust their driving behaviour to the local road conditions (i.e., road geometry and meteorological conditions; Chan, Pradhan, Pollatsek, Knodler, & Fisher, 2010; Fisher, Rizzo, Caird, & Lee, 2011). In low-speed zones (i.e., 40 km), young Australian drivers typically exceed the speed limits by 10 km/h, and in high-speed zones (i.e., 80 km), they typically exceed the speed limit by 4–5 km/h (Ellison, Greaves, & Daniels, 2011). The consequences of speeding are acute, and affect other road users including other motorists, motorcyclist, cyclists and pedestrians. The challenge remains how to improve young drivers' speed management behaviour, and hence is the focus of the present research.

Decisions about the appropriate speed at which a vehicle should be driven are highly influenced by the individuals' motives and attitude toward speeding, as well as their perception of the risk/s and their ability to manage these risks (Aberg, Larsen, Glad, & Beilinsson, 1997). Positively influencing these attitudes and motives has the potential to improve young drivers' speed management behaviour (Senserrick & Swinburne, 2001). Molesworth, Wiggins, & O'Hare, 2006 found that an effective method to achieve better risk management behaviour is to involve individuals cognitively in the task. Otherwise known as cognitive-based training, such training has been effective in a variety of domains including: aviation, road, medicine and education (Molesworth, Bennett, & Kehoe, 2011; O'Hare, Mullens, & Arnold, 2010; Rittle-Johnson, 2006).

* Corresponding author.
E-mail address: o.krasnova@unsw.edu.au (O. Molloy).

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1.1. Cognitive-based training methods

Cognitive-based training methods focus on improving and/or mastering the cognitive skills required for safe and efficient operations (i.e., detection, attention, hazard perception, risk management and decision-making). For operating a motor vehicle, cognitive skills are particularly important in anticipating and/or managing hazards and the risk they present on the road (Beanland, Goode, Salmon, & Lenne, 2013). Various cognitive training methods (i.e., relapse prevention, commentary training; self-explanation; reflection) have been employed to address these skills. Among these, self-explanation and reflection showed positive results in improving operators' risk management behaviour (Molesworth et al., 2006; O'Hare et al., 2010; Prabhakharan & Molesworth, 2011).

1.1.1. Self-explanation

Self-explanation can be described both as a 'cognitive method' and 'active learning strategy', which focuses attention on explaining one's actions to oneself (Rittle-Johnson, 2006). Through this process, individuals acquire a better understanding of the content, and hence improve learning objectives (Ainsworth & Loizou, 2003). Rittle-Johnson (2006) investigated the effect of self-explanation with or without instruction on learning and transfer of knowledge in the education environment. It was found that both self-explanation and instruction facilitated better learning of correct procedures, and the former supported retention of these procedures over two weeks.

The effectiveness of self-explanation has also been shown in areas/fields such as: educational environment (Rittle-Johnson, 2006), mathematics (Hilbert & Renkl, 2009), computer programming (Bielaczyc, Pirolli, & Brown, 1995), prose comprehension (McNamara, 2004), and risk management (Molesworth, Tsang, & Kehoe, 2011; Molesworth et al., 2006; O'Hare et al., 2010). Although self-explanation has shown promising results in improving human behaviour in different areas, there appears to be no research examining the effect of self-explanation on drivers' speed management behaviour, and skills retention over longer-term period (i.e., 6 months).

1.1.2. Reflection

Reflection training is another cognitive method, which focuses on developing experiential knowledge that can help to make better decisions (Henley, Anderson, & Wiggins, 1999). Reflection training involves analysis of case-based scenarios through a series of questions (i.e., 'what happened?' and 'why it happened?'), as well as providing alternative actions and considering the outcomes of the scenarios, which help to generate reasonable judgements and enhance the decision-making process (O'Hare et al., 2010).

A review of the literature on reflective strategies provides evidence that it can foster learning (Lee & Hutchison, 1998; McNamara, 2004) in areas such as: motor learning (Gotoda, Sakurai, Matsuura, Nakagawa, & Miyaji, 2013), professional education (Lyons, Halton, & Freidus, 2013), medical education (Carek, Geiger, Oelklaus, James, & Karty, 2013), law education (Rue, Font, & Cebrian, 2013), and decision-making (O'Hare et al., 2010). However, like self-explanation, there is no known research examining its application in the area of speed management behaviour, and skills retention.

1.1.3. Feedback

A third intervention that has shown promise in training cognitive skills is feedback. As the name suggests, feedback involves providing specific information about an individual's action/s (Hatakka, Keskinen, Gregersen, Glad, & Hernetkoski, 2002). Feedback is thought to facilitate the accurate appraisal of a situation (Kuiken & Twisk, 2001), hence resulting in more complete and representative knowledge (Kluger & DeNisi, 1996). In the road environment, performance feedback has been shown to improve speed perception skill, resulting in more accurate speed estimation (Hill & Salzman, 2012; Oei & Polak, 1992). According to Groeger and Brady (1999), feedback plays an important role in the training of complex skills, which are thought to be learnt more efficiently, following the receipt of important non-biased information about one's actions.

1.1.4. Aims

The aim of the current study is to investigate the utility of three cognitive-based training methods, including various combinations, in order to improve young drivers' speed management behaviour. Specifically, the effects of feedback on young drivers' speed management behaviour, paired with self-explanation and reflection, as well as in isolation will be compared to a control group, void of any cognitive-based training. The immediate and short-term effects (one week post-training), as well as the longevity of these training methods (six months post-training) will be investigated. Hence, the present study was designed to answer the following two research questions.

1. What is the utility of the cognitive training interventions on young drivers' speed management behaviour immediately after training and one week post-training?
2. What is the longevity (6 months) of these cognitive training interventions?