The effect of training approaches and feedback for young and novice drivers on the relationship between the actual and perceived speed

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Poor speed management is a major contributing factor to motor vehicle crashes involving young drivers on New South Wales roads (RTA, 2010). Traditional approaches to speed management, involving regulation and enforcement, have had only partial success in reducing young drivers’ tendency for speeding. Therefore, the aim of the present research was to test the effects of two metacognitive training methods namely, Self-Explanation and Reflection, both with and without Feedback on young drivers’ actual and perceived speed management behaviour. One hundred and two young drivers took part in the driving simulator study. The results revealed that Feedback was effective in all experimental conditions. Self-Explanation with Feedback was also found to be effective, reflecting positively on the relationship between actual and perceived speed in 40kph, 60kph and 80kph speed zones, ultimately improving young drivers’ speed management and awareness skills. These findings provide directions for developing effective training programmes for novice drivers to improve speed management.

Practitioner Summary: This study contributes to a better understanding of the effect of two metacognitive training methods and feedback in improving young drivers’ speed management skills as well as their speed assessment skills. In doing so, this study will assist in developing effective training programmes to improve young drivers’ speed management behaviour.

Keywords: speed management, driver training, young drivers

1. Introduction

According to the New South Wales (NSW) Centre for Road Safety (2013) there has been a decrease in overall road fatalities in the last 10 years. However, excessive speed remains the leading contributing factor in motor vehicle crashes (Chen et al., 2009). Young drivers also remain overrepresented in these statistics (Williams, 2006) and as a result, are the highest risk group compared to all other age groups (2000-2012; BITRE 2013). For young drivers, poor speed management is particularly problematic (Clarke et al., 2006), possibly more so than for any other age group; young drivers commonly underestimate the dangers of speeding and the likelihood of being involved into a motor vehicle accident (McKenna & Horswill, 2006). According to McKnight and colleagues, this distorted belief about speed and accident involvement is derived from a combination of inexperience and overinflated perception of their own skills in relation to the ‘average’ driver (i.e., overconfidence; McKnight & Peck, 2003; DeJoy, 1992; Groeger & Grande, 1996).

In an attempt to address these two issues, driver licensing programmes in NSW employ driving training courses for young drivers (i.e., Safer driver course, Keys2drive), hazard perception training, as well as impose restrictions (i.e., speed limitations, limitations of number of passengers permitted to carry) on young drivers (all form part of the Graduate Driver Licensing Programme). Such programmes are designed to progressively build on drivers’ motor handling skills through exposure. However, they fail to address the
issue about driver overconfidence, namely distorted self-belief about driving skills or competence. One method that has shown promise in addressing operators’ overconfidence, however not in the road domain, but in aviation is a metacognitive training approach. Moreover, Molesworth and colleagues have employed Self-explanation and Reflection training methods to improve young pilots’ risk-management behaviour (Molesworth et al., 2006).

Self-explanation involves explaining oneself the meaning of the task just engaged in (Rittle-Johnson, 2006), while Reflection involves contemplating one’s behaviour in relation to the risks, through a guided approach (O’Hare, Mullens, & Arnold, 2010). Providing Feedback, appropriate to the task is an important aspect of both training techniques (Hattie & Timperley, 2007). Therefore, the aim of the present research is to build on these findings and examine the utility of two metacognitive training methods namely, Self-explanation and Reflection, along with Feedback in order to improve young drivers’ speed management behaviour. Since it has been identified that young drivers overestimate their driving skills, the present research will focus on both actual and perceived speed management behaviour. It was hypothesized that participants trained with a cognitive-based method would perform better (improved speed management skills – actual and perceived) than participants who receive no training (Control) and that Feedback will enhance young drivers’ performance and improve their perceived speed management behaviour.

2. Method

2.1 Participants
The participant sample comprised 102 young novice drivers (58 males), aged 18-25 years (M = 20.53; SD = 2.15), who held a provisional driver licence (or international equivalent). Participants were randomly assigned to one of six experimental groups. All participants were reimbursed $40 in the form of a gift voucher for completing the study. The research including all stimuli was approved in advance by the University of New South Wales Ethics Panel.

2.2 Design
The experimental design comprised a 3 x 2 factorial design. The first between groups factor containing three levels was Training (Control, Self-explanation, Reflection). The second between groups factor containing two levels was Feedback (No Feedback vs. Feedback). Two main dependent variables featured, namely: percentage of time speeding in three different speed zones (40kph, 60kph, 80kph), obtained in the driving simulator, and subjective ratings of time exceeding the speed limit obtained for each of the three speed zones.

2.3 Apparatus and material
The experiment was conducted in a fixed-based, low fidelity driving simulator. The driving simulator comprised: an Acer 27-inch wide screen LCD monitor (B273HU), a Logitech G25 Racing Wheel set (E-
UP15; the steering wheel, shifter module, accelerator, and brake), a driver-side car seat out of a 2002 Mazda 626 and a Deli 2.1 sound system (Zylux Acoustics Corporation; Model A525). The computer software employed for the driving simulator was STISIM Drive, version 2.08.04 by Systems Technology Inc. (http://www.systemstech.com/).

The material comprised: a Driver Behaviour Questionnaire (DBQ, Lajunen, Parker, & Summalä, 2004), a demographic questionnaire (i.e., age, gender and driving experience – supervised and unsupervised driver hours), and a post-drive questionnaire (i.e., number of violations and percentage of time exceeding the speed limit).

2.4 Procedure
The driving simulator study was conducted in two sessions, spaced one week apart. In the first session participants completed: the demographics questions, the DBQ questionnaire, a practice drive (5km), a baseline/training drive (10km), followed by the training intervention or a control activity. In the second week, all participants were asked to complete a practice drive (5km, the same practice drive presented in the first week) followed by 10km test drive, and finally a post-drive questionnaire.

The training intervention for the Self-explanation group involved explaining their speed management behaviour to themselves after completing the baseline drive (i.e. Did you exceed the speed limit in the drive? or What was the highest speed you exceeded during the drive?). For the Reflection group, the training intervention involved reading a case-based situation regarding a motor vehicle accident caused from excess speed and commenting on the driver’s poor speed management behaviour (i.e., Describe the risks involved in the drive; or What actions could the driver apply to avoid the car accident?). The Control group without Feedback received no training and as a result, were informed that this concluded the first part of the study, and a mutually suitable time was arranged in the following week to complete the second session. Feedback was also provided to half of the participants in each group. The Feedback focused on drivers’ speed management behaviour so that at the end of the baseline drive in session one, participants were told the number of times they had exceeded the speed limit, the likely safety outcomes (i.e., risk to self and passenger) and financial implications (i.e. infringement notices) of such behaviour.

The training (week 1) and the test drive (week 2) involved driving a 10km route with different speed zones located throughout the drive in accordance with road design rules. The training and test drives comprised different surface features (i.e., scenery, building location), but similar abstract features (the patterns of speed limits). Participants were tasked to deliver newspapers at the delivery points specified at 40kph speed zones by throwing a newspaper over partition that separated the researcher’s and the participant’s console. All participants were advised to drive in accordance with the New South Wales road rules and regulations.

3. Results
Analysis of the baseline drive data and the DBQ revealed no statistically significant difference between six groups, indicating a positive random allocation method. Analyses in relation to the two dependent variables
involved a series of two-way factorial ANOVAs. Specifically, a total of six two-way factorial ANOVAs were employed, three relating to actual time exceeding the speed limit (in terms of percentage) and another three relating to perceived time exceeding the speed limit in each speed zone. Recall there were three speed zones, namely 40kph, 60kph and 80kph, translating into three analyses for the actual speed and three analyses for the perceived speed (total six analyses). In addition, a series of Pearson product-moment correlations were performed between objective and subjective percentage of speed exceeding the speed limit. Prior to all analyses, the data were screened to ensure it did not violate the assumptions underpinning parametric analyses, and in all analyses alpha was set at .05.

3.1. Actual and self-reported percentage of time speeding (40kph speed zone)

Results of the actual percentage of speeding for each Training and Feedback conditions in 40kph speed zone are shown in Figure 1a. The results revealed a significant main effect of Training, $F(2, 96) = 5.87$, $p=.004$, $\eta^2_p = .11$; a main effect of Feedback, $F(1, 96) = 54.32$, $p < .001$, $\eta^2_p = .36$; as well as a significant interaction between Training x Feedback, $F(2, 96) = 5.46$, $p = .006$, $\eta^2_p = .10$. Participants who received Feedback exceeded the speed limit on average 3.54% (SD = 4.96) compared to 29.56% (SD = 20.45) by the participants who did not receive Feedback.

Post hoc analyses for Training using Fisher’s Least Significant Difference (LSD) post-hoc test with alpha adjusted to .025 to control a familywise error, revealed a significant difference between the Control and Self-explanation groups (MDiff = 11.1, $p = .001$, 95% CI [4.54, 17.67]). No other statistical differences were evident. This result reflected positively on Self-explanation as a training method to improve drivers’ speed management behaviour.

Three Independent-Samples t-tests were employed using a Bonferroni adjusted alpha level of .017 to investigate the Training x Feedback interaction. The results revealed a statistically significant difference between the Feedback and No Feedback Control groups, $t(32) = 5.6, p < .001$; as well as the Feedback and No Feedback Self-explanation groups, $t(32) = 4.6, p < .001$. No other statistical differences were evident. These results suggested that Self-explanation with Feedback or Feedback alone affected young drivers’ performance and resulted in their better speed management behaviour.

Results of the self-reported percentage of speeding for each Training and Feedback conditions are shown in Figure 1b. The results revealed a significant main effect of Training, $F(2, 96) = 7.68$, $p = .001$, $\eta^2_p = .14$, a main effect of Feedback, $F(1, 96) = 4.82$, $p = .03$, $\eta^2_p = .05$, and significant Training x Feedback interaction, $F(2, 96) = 6.70$, $p = .002$, $\eta^2_p = .12$. Participants who received Feedback exceeded the speed limit on average 10.52% (SD = 9.52) compared to 18.31% (SD = 13.73) by the participants who did not receive Feedback.

Fisher’s (LSD) post-hoc test for Training with alpha adjusted to .025 revealed a significant difference between the Control group and the Reflection group (MDiff = 14.43, $p < .001$, 95% CI[7.09, 21.75]). No other statistical differences were evident. These resulted showed that participants trained with Reflection method considered themselves to drive over the speed limit less, compared to the Control group.
Three Independent-Samples t-tests were conducted with alpha level of .017 to investigate the Training x Feedback interaction. The results of the t-tests revealed a statistically significant differences between the Feedback and No Feedback Reflection groups, $t(32) = 3.10, p = .004$, as well as between the Feedback and No Feedback Control groups, $t(32) = 2.54, p = .016$. No other statistical differences were found. These results revealed that participants in the Reflection training with No Feedback perceived they were speeding less than they actually did, and significantly lower then when trained with the Reflection and Feedback. However, participants in the Control group with No Feedback perceived they were exceeding the speed considerably more than the Control with Feedback group.

### 3.3 Actual and self-reported percentage of time speeding (60kph speed zone)

Results of the actual and self-reported percentage of speeding for each Training and Feedback conditions in 60kph speed zone are shown in Figures 1c and 1d. The results of actual percentage of time speeding revealed a significant main effect of Feedback, $F(1, 96) = 38.4, p < .001, \eta^2_p = .29$, as well as a main effect of self-reported percentage of time speeding, $F(1, 96) = 17.4, p < .001, \eta^2_p = .15$. No other statistical differences were evident. Participants who received Feedback exceeded the speed limit on average for 2.08% (SD = 4.27) compared to 22.20% (SD = 19.42) for the participants who did not receive Feedback. In terms of self-reported percentage of time speeding, participants who received Feedback reported speeding for 5.29% (SD = 4.57), compared to 19.49% (SD = 13.47) for the participants who did not receive Feedback.

### 3.4 Actual and self-reported percentage of time speeding (80kph speed zone)

Results of the actual and self-reported percentage of speeding for each Training and Feedback conditions in 80kph speed zone are shown in Figures 1e and 1f. The results of actual percentage of time speeding revealed a significant main effect of Feedback, $F(1, 96) = 20.4, p < .001, \eta^2_p = .17$, as well as the results of self-reported percentage of time speeding, $F(1, 96) = 14.6, p < .001, \eta^2_p = .13$. No other statistical differences were evident. Participants who received Feedback exceeded the speed limit on average for 2.62% (SD = 4.69) compared to 13.77% (SD = 8.21) for the participants who did not receive Feedback. In terms of self-reported percentage of time speeding, participants who received Feedback reported speeding for 4.08% (SD = 6.05), compared to 16.35% (SD = 12.68) for the participants who did not receive Feedback.

### 3.5 The relationship between the actual and self-reported speed management behaviour

The correlational analysis revealed a relationship between the actual and perceived time speeding for the Self-explanation with Feedback group in 40kph, 60kph, 80kph speed zones respectively, $r(100) = .53, p = .03$; $r(100) = .56, p = .02$; $r(100) = .63, p = .007$, and for the Reflection with Feedback group in 60kph speed zone, $r(100) = .64, p = .006$. These results reflect positively on the Self-explanation with Feedback group, as in all speed zones, there was a positive relationship between the objective and subjective data, indicating better perception and awareness of their driving behaviour in respect to speed.
4. Discussion

This study was designed to test the effects of two Cognitive-based training approaches and Feedback on improving young drivers’ speed management behaviour as well as their perception of speed. The results revealed that the effects of ‘Feedback’ on performance was highly effective across all experimental
conditions, both in the actual and perceived conditions (i.e., speed management). Self-Explanation with Feedback was also shown to be an effective metacognitive training method, reflecting positively on the relationship between actual and perceived speed in 40kph, 60kph and 80kph speed zones. This means that participants trained with Self-explanation and Feedback obtained better perception and awareness of the driven speed in all speed zones. These results were in line with the previous study where the Self-explanation training approach was found to be effective (Rittle-Johnson, 2006, Molesworth et al., 2011). Therefore, when young driver training is directed to ‘self’ rather than ‘significant other’, vehicle speed is better maintained within the limit, and the perceived speed is more accurately reported.

### 4.1 Limitations and further research

While the results reflected positively on the Self-explanation and Feedback as an effective approach in improving young drivers’ speed management behaviour, the study is not without its limitations. Firstly, driving simulator environment does not fully represent the real driving condition, and therefore generalisation of these findings remains unknown. Secondly, the research consisted of two sessions one week apart and positive trend was found in improving young drivers’ speed management behaviour within short-term period of time. However, what remains unknown is whether these results will persist over a longer period of time, a time period in excess of one week.

### 5. Conclusion

The findings of this study revealed the importance of Cognitive-based training and Feedback interventions, which could lead to young drivers’ speed reduction and maintaining the appropriate level of speed control. Specifically, Feedback was highly effective in improving actual and self-reported speed management behaviour in all (40kph, 60kph, and 80kph) speed zones. In addition, participants who were trained with Self-explanation and Feedback exhibited the best speed management behaviour consistently across all tested variables, which resulted in more cautious and slower driving comparing to other participants. This training approach enhanced young drivers’ speed perception and speed awareness skills. Therefore, directing young driver training to ‘self’ rather than ‘significant other’ produces better speed management and perceptions of speed. These results provide directions for developing effective training programs for novice drivers to improve speed management.

### References:


