A Participative Education Program to Reduce Speeding In a Group of Work-Related Drivers.

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Abstract
A number of intervention approaches have been developed to improve work-related driving safety. However, past interventions have been limited in that they have been data-driven, and have not been developed within a theoretical framework. The aim of this study is to present a theory-driven intervention. Based on the methodology developed by Ludwig and Geller (1991), this study evaluates the effectiveness of a participative education intervention on a group of work-related drivers ($n = 28$; experimental group $n = 19$, control $n = 9$). The results support the effectiveness of the intervention in reducing speeding over a six month period, while a non significant increase was found in the control group. The results of this study have important implications for organisations developing theory-driven interventions designed to improve work-related driving behaviour.

Keywords
work-related driving, interventions, behaviour modification

Introduction
Australian and overseas research suggests that road crashes have become the most common form of work-related death, injury, and absence from work [1, 2, 3]. In the United States, work-related driving crashes accounted for the highest number of occupational accidents (Bureau of Labor Statistics, 2004). Similar trends have also been found in Australia and the United Kingdom, even after adjusting for exposure in the vehicle [2, 4, 3].

Past literature presents a number of intervention approaches designed to improve work-related driving safety outcomes [5, 2]. In this paper, we critically evaluate past interventions designed to improve work-related safety outcomes (e.g., behaviours, crashes). We then discuss a behavior modification approach that has overcome many of the limitations of past intervention programs. The aim of this paper is to present a modified version of this approach and assess its effectiveness in improving self-reported speeding in a group of work-related drivers.

Work-related driving interventions

Driver training: Driver training has long been acknowledged as one of the leading work-related driver safety interventions [e.g., 5, 2, 3]. However, over the past two decades there has been much debate on the safety benefits associated with driver training. Early research showed minimal effectiveness in its use [e.g., 7]. One reason for this is that past research has neglected the theoretical mechanisms underpinning effective training strategies [8]. It has been argued driver training programs are limited due to a reliance on knowledge and vehicle handling skills, rather than addressing the factors effecting judgement and decision-making (e.g., attitudinal factors), and their failure to incorporate behavioural objectives and teaching strategies [8, 9, 10, 11, 12].

It is believed that theory-driven research that is grounded in sound educational and psychological principles is required to gain an understanding of the behavioural change processes underlying driver training programs [8, 13]. One good example of a strong theoretical link is a conceptual model of driver training and education known as the “Goals and Contents of Driver Education Framework” (GDE framework) [14]. This framework identifies four hierarchical skills and the tasks associated with driving. More importantly, this framework incorporates motivational and active learning components in its approach to driver education, and thus is strongly linked with psychological and behavioural change principles.

Behaviour modification: A second approach to improving work-related driving performance is through behaviour modification. One behaviour modification intervention that has been widely used in the work-related setting is incentive schemes. Based on the operant perspective [15] to behaviour change, this approach has provided rewards (e.g., money) for safe driving behavior. Mixed support has been
found for the role of incentive schemes in reducing crashes [11], and increasing employees use of seat-belts [e.g., 16, 17, 18, 19, 20, 21, 22].

A second behaviour modification approach to improving work-related driving performance is participative education. This approach typically involves a discussion based format, whereby employees are encouraged to participate in generating ideas to improve their safety performance. Past research has found support for participative education based interventions in improving work-related driver safety performance [11, 23]. Most recently, Salminen [24] conducted three rounds of group discussions which consisted of (1) identifying problems in work-related driving traffic (2) discussion of solutions to the identified problems, and (3) discussion of the decisions regarding the identified problems. The results of this study found that the group discussions decreased work-related driving accidents, while no change was identified in occupational accidents not related to traffic. Although this was a well conducted study, there was no discussion of the behavioral techniques undertaken to achieve these results, and as such it is difficult to pinpoint the processes that explain why this initiative was successful, and to generalize the results for future applications.

Ludwig and Geller [25] also used participative education to improve safety outcomes in the work-related driving setting. The strength of this study was that the authors explicated the behaviour change mechanisms underlying the development of their intervention. Utilizing the ABC framework [i.e., Antecedent-Behavior-Consequences; see 26] this study adopted the behavioral change techniques of discussion/consensus and commitment, and evaluated the impact of a group interactive awareness session and signing of pledge cards (i.e., written activator) to increase safety belt use in a sample of pizza delivery drivers. The study found support for the intervention as the results showed a significant increase in safety belt use, while the control group showed no change over the course of a seven month intervention. This study also found a generalization effect, whereby turn-signal use increased relative to baseline. The results of this study suggest that a participative education session which includes a safety commitment component, in addition to frequent feedback was an effective method of modifying safety behavior, even after cessation of the intervention phase.

Development of a new work-related driver safety intervention

Based on the success of Ludwig and Geller’s [25] study, the aim of this study is to utilize a modified version of the methodology adopted by these authors and evaluate the effectiveness of an intervention designed to improve self-reported speeding. However, three major changes were adopted in this study. First, based on the ABC framework, Ludwig and Geller utilized the behavioral techniques of discussion/consensus, commitment and a written activator. In adopting these techniques, one of the strategies used in the Ludwig and Geller study was the signing of promise cards, which was considered to be the written activator. However, due to legality issues surrounding the signing of pledge cards, this strategy was not adopted in this study. As such, the signing of the pledge cards was omitted from the intervention phase.

Second, rather than signing of pledge cards, this study adopted the use of goal setting and feedback as behaviour modification techniques. Consistent with past research [e.g., 16, 22, 27] and the operant perspective to behavior modification [15], this study used a positive consequent, feedback, in combination with goal setting, as the antecedent, to modify behavior. In support of this approach, goal setting and feedback have been found to be effective modification technique combinations for improving safety behavior [e.g., 28, 29]. For example, Lingard and Rowlinson [27] utilized goal-setting meetings which aimed to establish safety performance goals, followed by feedback charts based on behavioral observations. These behavior-based safety techniques were found to be effective in improving safety performance (i.e., site housekeeping) in the construction industry. As such, past research supports this modification technique combination in improving safety behavior.

In past research, feedback is generally given in the form of charts reflecting external observations (e.g., safety belt use) of individual performance [e.g., 27]. However, in this study it was not impossible (due to the lack of objective speed monitoring devices) to gain objective data on driving speeds. As such, feedback will be given in the form of reminders of the group safety goals generated in the initial safety session. In this form of feedback, at three and six months of the intervention process participants will be asked to reflect on whether their current behaviour is congruent with the goals they established in the initial safety session. As such, the influence of feedback on behaviour in this study is contingent on
drivers undertaking a process of reflecting on their own behaviour and recognising whether their behaviour matches the safety goals designed to reduce driving speeds.

A third modification to the methodology in this study was a focus on self-reported speeding as the outcome measure, rather than seat-belt use as used in the Ludwig and Geller study. Given this modification, the topics that were discussed in the safety awareness session related to speeding. Furthermore, the goals generated by the group were associated with strategies designed to reduce speeding while driving for work purposes. We chose to focus on speeding as this behavior has been found to be one of the leading contributing factors to work-related crashes [5, 30, 31].

In summary, this study utilises the ABC framework to evaluate the effectiveness of a work-related driving intervention designed to reduce speeding. Specifically, we will be utilizing the behavior change techniques of goal setting and feedback to achieve a reduction in self-reported driving speeds. As such, this study will be extending on the work of Ludwig and Geller through (1) adopting goal setting as an antecedent to focus on the specific performance goals required to reduce driving speeds, and (2) utilizing the goals specified in the initial discussion session as feedback to drivers at three and six months of the intervention phase. As such, we hypothesize that:

Hypothesis one: Involvement in the participative education intervention will result in lower self-reported driving speeds, compared to a control group.

Methods

Participants

The research was conducted in partnership with a group of work-related drivers within one of Australia’s largest nonprofit organizations. Participants were involved in community-based work, which required them to drive for work purposes. The participants were randomly recruited through the management structure of the organization. In the initial round of baseline data, 47 drivers completed a questionnaire (67% participation rate). However, due to attrition only 28 participants provided a complete set of data that could be matched using contact details collected at baseline. The participants were matched through their initial survey responses, where they gave their names and contact details (e.g., email or post). In the final response rate at six months, there were nineteen participants in the experimental condition and nine in the control group. This sample represents a final response rate of 40%, which indicates a reduction of 17% from the initial round of baseline questionnaire data. Based on the final sample of 28 participants, the majority of the sample were male (81%) with the average age being 52 years (range 28 to 71 years of age). The average kilometres driven per week for work-related purposes was 338kms (range 50km to 1200km). All participants drove a vehicle at least once per week for work-related purposes.

Procedure

The participants were divided into two groups, one of which served as the experimental group and one of which served as the control group. The participant group were similar in their demographics, kilometres driven per week, and general driving conditions (suburban vs rural driving). In the final sample, 19 participants were included in the experimental group and 9 were in the control group. Participants in the experimental group were asked to complete a questionnaire and take part in a one-hour safety awareness discussion group. Participants in the control group were asked to complete a questionnaire, but they did not participate in the one-hour safety awareness discussion. Furthermore, the control group was not made aware that they were being treated as a control group. Participants in the control group worked independently to those in the experimental condition and as such were not aware of the intervention program involving the safety awareness session.

One-hour safety awareness session: The safety awareness session lasted for one hour, during which the research leader (the first author) facilitated discussion of three issues. The first issue presented was an overview of the importance of safety when driving for work purposes and past research in the work-related driving field. Second, there was a discussion of the value of safety and motivations for speeding when driving for work purposes. Third, feedback relating to past self-reported speeding in the organisation was presented to the participants (from questionnaires administered the previous year). The final issue was a discussion and generation of safety goals. The goals were set as non-numerical...
goals, and participants were asked to ‘do your best’ over the next six months to reduce speeding while driving for work purposes [for a discussion on non-numerical goals see 32]. It is important to note that group consensus was attained on each of the goals generated by the group. The safety goals generated by the group were given as feedback to the participants at three and six months.

Safety goals: At three and six months, participants were given feedback of the safety goals via their preferred method indicated in the pre-intervention surveys (e.g., phone, email, or post). The list of goals formulated in the initial safety awareness discussion were (1) Do not speed between appointments if you are running late (2) Avoid speeding by pulling over to the side of the road and ring ahead if you are going to be late (3) If you have cruise control on your vehicle, try and use it to ensure you keep within the speed limits (4) Be aware of the changes in driving speeds in the city and rural areas.

Measures

To establish the effectiveness of the intervention over time, identical questionnaires to the pre-intervention questionnaires were administered to participants in the intervention and control groups at three and six months (following the feedback on the safety goals). The questionnaires were designed to establish baseline data of self-reported speeding. The following specify the measures adopted in this study.

Self-reported speed: Speeding was assessed with three items specifically developed for this study. The items were prefaced by a sentence that provided context to the work-related driving setting. The items were “In a typical week when driving for work purposes how often do you (1) Deliberately exceed the speed limit on a residential road, (2) Deliberately exceed the speed limit on a highway or freeway, and (3) Deliberately exceed the speed limit when traveling to clients or the office. All items were measured on a 5-point Likert scale, ranging from Rarely or Never (1) to Very Often (5). This scale was found to be internally consistent with Cronbach alpha of .74 at Time 1, .75 at Time 2, and .73 at Time 3.

Control variables: Kilometres driven per week for work purposes was used as a control variable in the analysis as past research has found that above average annual mileage to be a potential factor contributing to work-related vehicle crashes [4]. In the general driving section of the questionnaire, a space was provided for the participants to indicate how many kilometres they drove per week.

Results

The effect of the intervention on speeding behavior was tested with a repeated measures analysis of variance model. Kilometres driven per week was used as co-variate in the model. Figure 1 shows participants mean driving speeds across the intervention, and a significant interaction between the intervention phase (pre-intervention, three months, six months) and the experimental condition, $F(2,22) = 3.59$, $p<.05$, adjusting for kilometres driven per week. The results are presented in Table 1. After applying a Bonferroni adjustment, post hoc analysis revealed a significant decrease in self-reported speeding for the experimental group from baseline to six months ($p = .018$), accompanied by a non-significant increase for the control group at each phase of the intervention (pre-intervention, three and six months) ($p = ns$). These results suggest that the intervention had a positive effect, whereby the initial safety awareness session, followed by feedback of safety goals given at three and six month reduced self-reported driving speeds. As such, the results supported Hypothesis 1 regarding an improvement in speeding behaviour as a result of the intervention.
Figure 1: Interaction between intervention phase and experimental conditions for self-reported speeding.

Table 1. Repeated Measures Analysis of Variance for Self-Report Speeding

<table>
<thead>
<tr>
<th>Component</th>
<th>$F(2,22)$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between group condition (Experimental vs Control group)</td>
<td>.159</td>
<td>$ns$</td>
</tr>
<tr>
<td>Control: Kilometres driven</td>
<td>1.78</td>
<td>$ns$</td>
</tr>
<tr>
<td>Within group condition (Self-reported speed at Time 1, 2, 3)</td>
<td>.125</td>
<td>$ns$</td>
</tr>
<tr>
<td>Control: Speed x Kilometres</td>
<td>.034</td>
<td>$ns$</td>
</tr>
<tr>
<td>Between and Within Group Interaction</td>
<td>3.59</td>
<td>$.05$</td>
</tr>
</tbody>
</table>

Discussion

No research to date has examined the effect of a participative education intervention for reducing speeding in a group of work-related drivers. The study adapted and extended on the methodology utilized by Ludwig and Geller [25] and found support for a safety awareness session followed by feedback as an effective intervention in reducing self-reported speeding over a six month period. Specifically, we found the safety awareness intervention significantly reduced self-reported speeding in the experimental group, while participants in the control group reported a non-significant increase in speed across the three phases of the intervention. These results suggest speeding can be reduced through a process of participants generating their own safety goals, and giving feedback of these goals at regular intervals. This result supports past research which has used participative education to improve safety outcomes in the work-related driving setting [e.g., 11, 23, 25]. Furthermore, these results support past literature that has found support for the role of feedback [22, 29], and participative goal setting on improving task performance [32], and non-targeted behaviour [33].

Practical implications

No research to date has applied a participative education intervention to improve speeding in work-related drivers, and as such, the results of the current study offer suggestions for practitioners and future work-related driving research. In regards to the implications of these results for practitioners, organisations could adopt the methodology utilised in this study and conduct safety awareness sessions focused on other types of unsafe driving behaviour, such as inattention, tiredness while driving or rule violation. Followed by a process of providing feedback on the goals generated in the initial safety awareness sessions, it could be possible to observe changes in other types of unsafe driving behaviour, in addition to speeding.

In regards to future research, it would be interesting for future research to investigate the psychological mechanisms underlying any change in driving behaviour and/or crash outcomes. Specifically, it is possible that the reduction in driving speeds identified in this study could have been associated with a change in driving attitudes or perceptions of safety within the organisation. In addition to furthering our...
understanding of the psychological mechanisms underlying a change in driving behaviour, this research would assist in the development of future theory-driven interventions. Furthermore, to evaluate the long-term effectiveness of this or any other type of intervention, it would be advantageous for future research to conduct a follow-up at one or two years to evaluate change in behaviour and/or crashes post intervention.

**Limitations**

This study was shown to have a number of strengths both theoretically and methodologically. However, three limitations were identified. First, although the sample was believed to be representative of a work-related group within the participating organization, it is nevertheless represents a small sample, and thus there low statistical power. Given the small sample size, some of the non-significant results could have been attributed to this, especially given that the size of the control group. As such, it would be desirable to replicate this study with a larger group of work-related drivers.

Second, this study relied on self-report data for the outcome measure. As such, due to social desirability bias, it is difficult to rely on the accuracy of the results reported in this study. However, this is less likely to be an issue in this particular study as it has been shown that self-report driving questionnaires are associated with minimal social desirability bias [34]. Furthermore, organizational records of driving behaviors are known to be unreliable, as they are insufficiently sensitive, inaccurate, retrospective, and ignore risk exposure [35]. Based on these justifications, the self-report measure of speeding was believed to be a suitable outcome variable.

Third, it would have been desirable to assess a change in driving crashes or loss of demerit points. However, due to the short time interval we did not have enough variability in the data to accurately assess crashes and loss of demerit points. As such, future research should assess the impact of this intervention on these two outcome measures.

**Conclusion**

This study adapted and extended on the methodology developed by Ludwig and Geller [25] and developed an intervention designed to reduce self-reported speeding in a group of work-related drivers. Support was found for the intervention, as the results showed a significant reduction in self-reported speeding, relative to a control group. From a practical perspective, the results suggest an effective method of improving work-related driver safety behavior. Furthermore, the strong theoretical foundation underlying the design of this intervention will allow future research to build on the current approach and further explicate the mechanisms through which safety outcome can be achieved in this setting.

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**References**


