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How to Provide Effective Feedback to Young Learners: Lessons Learnt from Driver Training

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Abstract: In Australia, and around the world, there is a continuous debate about the ways of delivering a message, instruction, or feedback effectively to improve students' learning and performance. Contemporary cognitive skills training approaches have emerged as a result of further development of effective cognitive skills training in different contexts, such as education, aviation, and driving. One of the effective cognitive-based training is feedback. Feedback is an important component in learning, including the development of safe driving for novice drivers. Research shows that feedback can reduce the number of speeding occurrences, and the likelihood of speeding-related incidents and accidents, but it is not clear how to provide effective feedback to young learners. This paper reviews the literature and examines various aspects of feedback as a training intervention for young drivers and provides recommendation for effective use for young learners. The results explored the characteristics of feedback including multiple dimensions: content, source, medium of delivery, timing and frequency. Importantly, its effectiveness in improving an individual performance depends on effective utilization of these characteristics. The results showed that the most effective type of feedback (considering all feedback characteristics) in improving young novice drivers' performance in terms of speed compliance is *feedback about performance, financial and safety implications* (content), *provided verbally and graphically* (medium in which provided), *by an instructor* (researcher; source), *immediately after the drive* (time), *once or twice* (frequency). These results have important implications for the development of new training approaches to improving young drivers' speed management behaviour.

Key words: Driver training, young drivers, feedback.

1. Introduction

In Australia, and around the world, there is a continuous debate about the ways of delivering a message, instruction, or feedback effectively to improve students' learning and performance. Previous studies in a number of settings have shown positive results of feedback in realigning perception of skill with actual skill level [1-3]. In the medical profession, feedback has been used to improve the procedural skills of doctors [2]. In the context of driving, there is evidence that feedback facilitates safe driver behaviour and improves speeding behaviour [4], as well as drivers' compliance with speed limits [5] and traffic laws of seatbelt use [6]. In training, feedback is instrumental in the development of learning, skill, and performance [7].

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Various forms of driver training programs are used in almost all jurisdictions around the world, including professional driving instruction, supervised on-road driving experience, simulator training, insight training, and hazard perception training. Feedback is an essential part in each of these programs. Driver training is a specific component of driver education, aimed at forming targeted skills necessary for driving (e.g., steering, vehicle maneuvering, risk management [8]). Over the last two decades, the objectives of driver training have shifted from obtaining skills to pass the test, to maintaining safe driving behaviour [9]. Although driver training provides the necessary skills for safe driving, it cannot ensure that the skills transfer to practice or a driver's choice in how to drive [9]. Several researchers have raised the concern that apart from training basic car handling skills, the focus of driver training should be to address factors that attribute to high crash risk, as well as aspects of risk

management, decision-making, and self-assessment [1]. In addition, feedback provided as part of these programs has been seen as very effective in some studies to not effective in others. Hence, it yet remains to examine how to provide effective feedback and enhance learners' performance.

Feedback is broadly defined as the provision of information about a system or process that may affect a change in the process [10]. Effective feedback is argued to be the information about previous performance that is used to promote positive and desirable development [11]. Specifically, information about a system or process can comprise various aspects that can affect an individual [10]. Feedback assists in calibrating learner performance by providing the learner with information about the gap between their current and expected performance [12]. Feedback can also improve the efficiency in which skills are acquired [1]. Thus, the effectiveness of feedback is both contingent on the quality of the feedback provided by an educator, as well as the learner's perception and comprehension of the information contained in the feedback. Hence, the aim of this paper is to examine how to provide feedback effectively. The focus of this paper is to explore various components of feedback as the predictors of its effectiveness.

The effectiveness of feedback on learning and performance has also been well-documented in the literature. Specifically, previous research has also examined how feedback affects performance [13], how people learn with or without feedback [10], the efficiency in which skills are acquired [1], calibration of learner performance [12], how the feedback is conveyed, how it is delivered [1, 14], the frequency of feedback and whether it helps or hurts [15]. The choice of variables is considered to be detrimental in defining the success of feedback.

From a theoretical perspective, the importance of feedback in learning is evident from the following three theories: control theory [16], goal-setting theory [17], activation theory [18], cognitive load theory [19], and resource allocation theory [20]. According to the "Activation Theory" [18], feedback can induce cognitive overload on an individual, resulting in the reduced effect on learning or performing a task. From the control and goal-setting theories, the benefits of feedback include specific information on how well individuals are performing relative to their goals [17], as well as the amount of effort needed to achieve specific objectives [16]. However, activation theory and cognitive load theory highlight that feedback can induce the overload on an individual, resulting in the reduced effect on learning or performing a task [18, 19]. Despite the theoretical perspectives of feedback, as evident from previous research, the effectiveness of feedback on performance depends on different characteristics of feedback [13].

The characteristics of feedback include multiple dimensions: content, source, medium of delivery, timing and frequency [21]. Importantly, its effectiveness in improving an individual performance depends on effective utilization of these characteristics [13]. Specifically, there can be many ways of employing feedback and the effect on performance may vary in different contexts and areas of application (i.e., education, medicine, driving, aviation [21]). Earlier studies suggested that feedback can help in improving learning and performance [13, 21]. However, recent research suggests that feedback can hurt individual learning in complex tasks [12], particularly depending on its frequency [22]. Hence, the main aim of this paper is to review feedback dimensions and report best practices of feedback dimensions on young learners' performance in the context of driver education.

2. Best Practices in Using Feedback Dimensions

2.1 Content of Feedback

The effectiveness of feedback can vary with the type of content. For example, verbal feedback can be formulated as a statement, a question, hypothetical

information, or a reminder to name a few. The content of feedback has been researched in a number of studies and is divided into evaluative or non-evaluative [23]. The evaluative feedback can provide information on actual performance as well as how it measures up against some standard or how it might be improved. Evaluative feedback provides information about individual's performance including explanation of potential reasons for the performance and recommendations for its improvement, whereas non-evaluative feedback provides information only about an individual's performance without explaining reasons and providing recommendations for improvement [23, 24]. Feedback that emphasizes the consequences of actions has also been shown to be more effective [25].

In the driving context, Dogan et al. [24] conducted a study examining the effect of non-evaluative performance feedback on driver performance and self-evaluation. Feedback about performance was provided to participants during the hazard perception test, while another group did not receive any feedback (control). Participants received non-evaluative feedback about their performance (i.e., scores) following each hazard perception clip and overall scores after completing the test. The results revealed that non-evaluative feedback on the hazard perception test was not effective in improving driver self-evaluation and actual performance. Dogan et al. [24] assumed that driver performance did not change over time because the non-evaluative feedback did not indicate the reasons for existing performance, as well as its consequences or recommendation on how it can be improved.

Kruger and Dunning [26] argued that effective feedback should contain information about the reasons for the driver's failure or success, as well as direct them on what to do in order to improve performance i.e., evaluative feedback. Specifically, it is difficult for novice drivers to assess their own skills realistically, and they need to receive feedback from an instructor or an in-car device to be aware of their mistakes and the ways to avoid these mistakes. Therefore, Kruger and Dunning [26] argued that young novice drivers require evaluative feedback to develop a sense of realistic abilities and performance on the road. The effect of evaluative feedback was also examined in the study by Goodman and Wood [23]. One hundred and ninety-two participants took part in a management decision-making task simulation that required them to answer questions about the workers' performance in a company. Feedback was provided continuously on the computer screen in the form of brightly colored messages (i.e., red messages on a blue background) that flashed when updated to direct the participant's attention. Evaluative feedback was divided based on the level of specificity of content (i.e., low, moderate, and high). Low feedback specificity comprised outcome feedback of weekly job performance of others (i.e., three random workers and the team overall). Moderate feedback specificity consisted of the same type of outcome feedback as the low group, and error feedback about workers' decisions. High feedback specificity included the same type of outcome feedback as the low group, and more specific error feedback compared to the moderate group about every decision made by each worker. The study was conducted over two sessions that were two days apart. The results showed that feedback with various levels of specificity affected individual performance. Specifically, a high level of specific evaluative feedback showed the most benefits in improving learning and performance errors compared to other types of feedback [23]. The authors concluded that the higher level of specificity, the more effective the feedback is. This is because high specificity feedback includes information on the behaviors performed incorrectly, and provides directions to correct behaviour, which can lead to performance improvement and a reduction in the number of errors [23]. Therefore, feedback about the outcomes of an individual driver's behaviour may be more likely to

motivate drivers to change their behaviour.

2.2 Media and Source in Which Feedback Is Presented

Feedback can be presented through two "media" (i.e., modes or forms): auditory or visual or a combination of these [21]. Feedback presented aurally is typically in the form of words or sounds. Feedback presented visually is typically in the form of: images, graphs, tables, figures, or text. In both modes, the absence of either (i.e., information) can also be considered feedback. Just as the mode of feedback delivery can vary, so too can its source of delivery. Both auditory and visual feedback can be generated by a human, mechanical or electronic device. Evidence from organisational settings, for example, shows that human feedback from supervisors, managers or teachers can be effective in improving performance [21]. Similarly, computer-based feedback has been found to be effective in organisational settings [27], especially in the form of evaluative feedback compared to simply summarizing performance. It seems that there is strong evidence supporting the effectiveness of feedback for performance improvement, but the most effective form of feedback varies depending on how and why it is to be used. This suggests that to gain the most benefit, feedback should be tailored to the specific setting.

Educational research in general suggests that the effectiveness of the feedback mode varies as a result of task being performed or area of application [28, 29]. For example, visual feedback in written form is said to be more appropriate when students need to utilize the information at a later date, whereas verbal (i.e., auditory) feedback is considered to be more effective when the volume of information to be communicated is large, and more than they would normally be expected to read [28]. A recent metanalysis of the effectiveness of feedback concluded that neither mode had an advantage [14]. This is also supported by evidence from specific settings. Research on medical education shows that verbal and written methods of feedback delivery are equally effective; hence method of delivery was not an important factor in education quality [29]. It is, therefore, possible that the medium in which feedback is delivered has different impact on individuals based on applied/research settings.

There are many examples in the literature of auditory and visual aspects of feedback mechanisms [8, 30, 31]. For example, De Waard and Brookhuis [8] conducted an experiment investigating the effect of auditory-visual feedback provided continuously via an in-car device on speeding. Twenty-four participants completed a series of drives on the road. Feedback was provided continuously from an in-car intelligent speed adapter on speeding. When a participant exceeded the posted speed limit, the in-car display changed from green to amber and then red. When the display turned red, it indicated that speed was exceeded by 10%. At the same time, an auditory warning message was provided notifying participant that he/she was going very fast (exceeding the speed by 10%) and reminded the participant of the current speed limit. The results indicated that the provision of auditory and visual feedback improved drivers' speed management and reduced the mean speed and speed variance, and drivers were more compliant with the speed limit (i.e., drive below the speed limit). Brookhuis and de Waard [32] conducted a similar driving simulator study examining the effect of auditory and visual feedback on driver speeding behaviour. Twenty participants took part in this study. These authors found similar results, where participants who received auditory and visual feedback reduced their mean speed by 8.95 km/h. Hence, auditory-visual feedback has shown promise in reducing speeding. It should be noted, however, that participants' satisfaction with the in-car system that provided feedback was low among young novice drivers [32].

An on-road field experiment was conducted investigating the effect of auditory-visual feedback on

driver speed performance [30]. Feedback was provided continuously during the drive through the in-car (Intelligent Speed Adaptation (ISA)) device in the form of warning beep signals and a flashing red light when the speed was exceeded. The study was conducted for four months. Participants drove in their own vehicles and received training (i.e., feedback) for one month. Afterwards, no training was provided, and participants completed post-training drives for three months. The results showed that there was a reduction of mean speed in short term when feedback was provided, but no long-term effects were found post-training when the feedback system was removed. Similar to the study conducted by De Waard and Brookhuis [8], auditory-visual feedback has shown to reduce mean speed on the road within the short term and when feedback was present [32]. In contrast, a study conducted in a driving simulator by Houtenbos et al. [31] showed no effects of auditory-visual feedback on driver speeding behaviour at intersections. Specifically, Houtenbos et al. [31] investigated the effects of auditory-visual feedback on driver behaviour at intersections (i.e., speed and presence of another user) in a driving simulator. Feedback was provided continuously from the in-car audio-visual display, with an auditory alert (i.e., beep) and visualization (i.e., blinking lights) of speed and direction of the car at intersections. The results showed no improvements in speeding behaviour, as mean speed was higher for the participants who received feedback compared to the control group who did not receive feedback. The authors recommended using the auditory feedback only, explaining that auditory feedback might attract the driver's attention without the need to move the eyes and head unlike visual feedback. Although this study did not show benefits of auditory-visual feedback, it was concluded that auditory feedback might be beneficial. However, the study was conducted in a driving simulator. Therefore, whether these results will generalize to the operational environment remains untested.

Visual feedback, however, was found to be effective when used with another intervention, the reward system, in a driving simulator study [33]. Specifically, Merrikhpour and colleagues [33] conducted a field trial and investigated the effect of visual feedback and reward system on speeding and tailgating driver behaviour. The feedback was provided continuously during the drive from an in-vehicle reward system device. Feedback intervention and rewarding points for speed and time headway compliance were provided to participants for 12 weeks and removed for the following two weeks (post-intervention). The results indicated improved speed and time headway compliance of participants compared to baseline when continuous visual feedback was provided. This effect declined when the feedback was removed, but it was better than baseline [33]. Although the positive effects of the feedback-reward system were found, it is unclear which component of training intervention contributed the most—feedback or reward, or a combination of both. Based on the aforementioned research examining various mechanisms of feedback, it appears that most of the studies examined a combination of auditory-visual feedback using in-car technology, or visual feedback from technology to a lesser extent. A combination of visual and auditory feedback has shown to reduce the percentage of time speeding in a driving simulator [32] and reduce mean speed on the road [30]. However, no long-lasting effect was found when these systems were removed [30]. In contrast, one of the reviewed studies showed that auditory-visual feedback is not effective in improving speeding behaviour, at least when tested in a driving simulator [31].

Recent studies on the effectiveness of verbal feedback alone have shown promise by improving young drivers' speed management behaviour in both a simulator [34, 35] and on the road in an instrumented vehicle [36] with benefits for speed management lasting up to six months. In all of these studies,

feedback about each driver's speed management during a designated drive was presented verbally by a researcher after the drive. The feedback emphasized the novice driver's performance in terms of compliance with posted speed limits and the potential financial and safety implications of speeding. In all of these studies, speed management feedback benefited performance for at least one week and up to six months [36]. The specific content of the feedback used in the current study was consistent with that used in these previous studies so results can be compared. An earlier study by Molloy et al. [34] investigated the relative effectiveness of each component of this feedback: performance compliance, financial and safety implications, and all feedback messages were found to be equally effective [34]. As the form of feedback was always verbal, however, it is not clear whether the content of the feedback would still be effective if presented in a different form.

2.3 Time of Feedback

The timing of delivery may also influence the effectiveness of feedback. Feedback can be (1) continuous (concurrent or real-time), occurring while the task is being performed; (2) immediate (temporally adjacent), provided immediately following the task; or (3) delayed, where feedback is provided after some time interval [37]. Prior research investigated continuous, immediate, and delayed feedback or a combination of these on young driver behaviour in driving simulator studies and in on-road studies [33, 38, 39]. From the reviewed literature, the words "continuous" and "immediate" feedback are used interchangeably and are assumed to have the same meaning. However, in this research immediate feedback is understood as feedback that is provided after completing the task (i.e., drive) as defined by Wickens et al. [37], whereas continuous feedback is ongoing. In the driving context, previous studies examined continuous and delayed feedback [38-40]. For example, Dijksterhuis et al. [40] conducted a driving simulator study investigating the effect of continuous and delayed, auditory-visual feedback on the "unsafe" behavior (i.e., speeding, braking, acceleration, and steering behaviour) of young Dutch drivers (18-25 years). The auditory-visual feedback was provided continuously from an in-car device (i.e., ISA) regarding driver unsafe behaviors, as well as information about rewards (i.e., for complying with the driving rules, participants received AUD $0.0015 per second) or penalties (i.e., for violating the rules, participants lost AUD $0.03 per second) for their behaviour. The continuous feedback was presented visually from the in-car driver UI (user interface), and if a driver was engaged in an unsafe behaviour for more than 6 s, an auditory warning feedback was provided until the behaviour returned to normal. The delayed feedback was provided to participants through the online web portal (i.e., Progressive Snapshot http://www.progressive.com/auto/snapshot/), where the data about participants' driving were stored. In order to receive the delayed feedback, participants needed to access the website, and did not receive information about their driving style and insurance charges until they checked their web-based feedback. The web address was emailed to the participants at the end of session 1. The website information showed the frequency of violations during the drive and associated rewards. The study was conducted over two sessions. The results of this study showed that groups trained with continuous and delayed feedback performed better (i.e., speed behaviour improved) than control (no feedback). However, it was also found that not all participants checked the information on the website, hence the effect of the delayed feedback remains unclear.

Dijksterhuis et al. [40] suggested that in-car continuous feedback is more effective than delayed web feedback training. In contrast, the benefit of a combination of continuous and delayed feedback was found in a field study conducted by Simons-Morton et al. [39]. These authors examined the effect of two

types of feedback, continuous and delayed, about risky driving events to teenage drivers only or to teenage drivers and their parents [39]. The first type of feedback was visual feedback in the form of green and red lights provided continuously to teen drivers following the risky events, and the second type of feedback consisted of a combination of continuous feedback provided to teen drivers and delayed feedback provided to parents. Continuous feedback was provided using an in-car technology. Delayed feedback in the form of event videos and evaluative ranking of their son/daughter compared to other teenage drivers was sent to the parents via emails. The feedback was provided for 13 weeks. The results indicated that continuous and delayed feedback was more effective than just continuous feedback in reducing risky driving [39]. It seems that providing information about possible consequences for behaviour to young drivers and their parents (continuous and delayed feedback) is more beneficial in improving young drivers' performance, than when providing the feedback to young drivers only. The lack of success of continuous feedback only may be due to a lack of content-based information in this type of feedback, as it does not provide consequences of risky behaviour, or ways to improve. However, in this study there was no control (no feedback) group. Therefore, the effect of continuous and delayed feedback compared to no feedback was not tested. Similarly, Klauer et al. [38] examined the in-vehicle, auditory-visual, continuous, and delayed feedback on learner and provisional young drivers on the road. The continuous feedback was provided through driver assistance technology in the form of an auditory three-tone alert and LED (light-emitting diode) lights when a potentially risky behaviour of teen drivers was detected (i.e., hard brake), while delayed feedback was delivered to parents and teen drivers via a website. Feedback was provided for the first six months post licensure and was then removed. The study examined the effect of feedback intervention during the six months (when feedback was provided) and one month after feedback was removed (the seventh month) on young driver unsafe behaviour (i.e., poor vehicle control, speeding, following too close to a car ahead). The results of this study indicated that when immediate and delayed feedback was present, the frequency of behaviour errors (most common errors were speeding, distraction, and poor vehicle control) was lower compared to one-month post-training, when feedback was removed. Interestingly, when feedback was removed, young driver behavioral errors increased. These results showed that continuous feedback was effective only when it was provided to young drivers during the drive. However, this effect reversed when the continuous feedback was removed. Overall, delayed feedback provided in the form of report to parents has a greater impact on young drivers compared to continuous feedback alone. Similar to the findings of Simons-Morton et al. [39], the study by Klauer et al. [38] showed that the perception of parents monitoring has an impact on young driver behaviour, regardless of whether they are actually monitoring the driving performance of their child. Thus, it is important to give the impression of parental monitoring. The findings of Klauer et al. [38] suggest that six months of driving with continuous and delayed feedback are not enough to establish prolonged safe driving behaviour. However, there was no control group in this study. Therefore, which type of feedback contributed more to the findings—continuous auditory-visual feedback from technology or delayed feedback and parental monitoring—remains unknown. Therefore, further research is required to determine whether provision of continuous feedback separately can produce better results. Based on the aforementioned research examining various mechanisms of feedback, it appears that most of the studies examined a combination of continuous and delayed feedback using in-car technology and in the form of reports to young drivers or their parents. As these types of feedback were used

in combination, it is not clear which type of feedback contributes to the success of feedback. Wickens et al. [37] suggested that while continuous feedback seems to be effective for improving driver behaviour, the benefit of continuous feedback for young novice drivers has been questioned on the basis that it introduces a secondary task element [37]. Providing continuous feedback may interfere with the primary task performed; the learner may not have the resources to attend to this type of feedback, and therefore there may have little training benefit. Further, Wickens and colleagues [37] also pointed out that delayed feedback may not be effective for learners as they may have difficulty in recalling information about the task. They argue that the optimal time for delivering feedback during skill development is immediately after the task as it can prevent memory failure and dual task interference (i.e., immediate feedback post-training), so that the learner receives guidance relevant to the performed task [37]. Although immediate feedback is considered to be the most effective type of feedback [37], there is little evidence provided in the driving context, particularly for young novice drivers; hence further research is needed.

2.4 Frequency of Feedback

Researchers have long been interested in the role of feedback on performance [13, 21]. Traditionally, more frequent feedback is viewed as having a positive effect on performance, Kluger and Denisi [13] argued that the evidence is not always consistent with this view, and that a lack of theory has hampered our understanding of the factors that condition its effectiveness. While earlier studies on feedback documented learning and performance improvements [13], more recent research has shown that effects of feedback are contingent on a number of characteristics of the feedback itself [38]. Some studies have shown that determining which feedback variables to use is more important than the process used to evaluate these variables. Other studies have shown that experience with a task does not always lead to performance improvement, and that outcome without cognitive feedback on the process leading to these outcomes can hurt learning in complex tasks [13]. There is now a consensus that the effect of feedback is contingent on the organisational setting in which it is provided and on the characteristics of the feedback itself [13, 21].

Although traditionally, more frequent feedback has been viewed as having a positive effect on performance [21, 41], the common rationale for this is the assumption that the more to provide feedback the better an individual can learn and develop effective strategies and as a result improve performance [42]. Some researchers in the past suggested that "more feedback leads to more learning and more superior performance" [42]. From a learning standpoint, more frequent feedback allows an individual to revise beliefs and try new strategies more often [43]. Some researchers consider frequent feedback to improve performance [22], while other researchers suggest that more frequent feedback may lead to degraded performance [15].

Lurie and Swaminathan [15] examined decision making and the ability of an individual to quickly respond to changes. The authors suggested that an increase in feedback frequency enhanced performance in an organisational environment but advocated that less frequent feedback may help to make better decisions in an organisational environment. Similarly, Payne et al. [44] stated that the frequent feedback may degrade performance as it affects the rapid change of decision-makers, failing to appreciate the content of the provided feedback. In addition, Casas-Arce et al. [45] argued that more feedback information does not necessarily lead to better performance in an organisational environment. In their study, researchers examined feedback provided weekly versus monthly for employees in an organization. The researchers found that when feedback is provided frequently (e.g., weekly), professionals perform significantly worse than their counterparts who receive less frequent

feedback (e.g., monthly).

Behavioral theories have questioned the positive effects of feedback frequency due to the level of details it may provide, and the recipient's attention to specific events that may inappropriately generalize with a small number of salient situations, rather than in a balanced learning inferred from all the information available, a phenomenon known as a "law of small numbers" [46]. Behavioral theories also suggested that more frequent feedback may cause the recipient to lose perspective and pay more attention to the most recent performance, making it more difficult to learn [15]. In addition, the information with very specific cues on how to improve performance may disengage from the learning process, relying exclusively on the cues from feedback [23].

Drawing from resource allocation theory [20], frequent feedback can overwhelm an individual cognitive resource capacity, thus reducing task effort and producing an inverted-U relationship with learning and performance over time. Similarly, Patchan and Puranik [47] advocated that the reduced effectiveness of frequent feedback could be due to capacity overload issues (e.g., too much feedback too often). However, what remains unknown is how often feedback must be provided to improve performance and whether the more frequent feedback delivery helps or creates a barrier when an individual may ignore it.

A common explanation for the inconsistent results of these studies is that they do not test purely the feedback frequency, but also include a level of detail and/or other reinforcers such as training interventions. For example, Wu & Schunn [48] examined the effect of feedback quality and feedback frequency on individual performance in education environment. The authors found that both factors were effective in improving students' performance. However, the results showed that when combining the two factors of feedback the quality of feedback based on details provided (e.g., high quality, medium-quality, low-quality) was more significant than the frequency of feedback provided. This showed the limited evidence to whether the quality of feedback, frequency or combination of the two have led to improvement in performance. Little number of studies examined the frequency of feedback on performance without considering other characteristics, like content, timing, way of feedback delivery.

Previous studies in the laboratory and field have shown that providing a single intervention (frequency) in the form of feedback about performance, financial and safety implications (content) presented immediately after the test drive (time) by a researcher (source) graphically (medium) improved speed management. The results showed reduction in average speed and time exceeding the speed limit up to 6 months [34-36, 49, 50]. In these studies, the frequency of feedback was provided in the form of a single training intervention.

In educational context training, the feedback characteristics are often examined in combination. In fact, separating each component of feedback to examine its effectiveness is difficult, and in many instances is just not possible. For example, from the reviewed literature, the medium in which feedback is delivered and the source of its delivery (i.e., an individual, or in-vehicle device) are usually intertwined and used in combination, so that auditory feedbacked provided via an in-car device [36]. All the above evidence suggests that feedback can be effective if each characteristic of feedback is employed to a specific setting and used in combination. While previous studies focused on the content, source, mechanism and time of feedback, there is little research available about the frequency of feedback.

3. Closing Thoughts

From the literature review, most studies showed that feedback was effective in various contexts [23, 30, 32, 38, 39]. While some studies demonstrated short-term effects of feedback [23, 32], a vast majority

of studies showed long-term effects of feedback [30, 33, 38, 39]. There is limited research available examining feedback alone, and in many cases feedback is examined in combination with other methods. In some of the studies that found feedback not effective, the following aspects of feedback were employed: (1) non-evaluative, visual feedback provided continuously using technology during the drive and used in combination with another method in a driving simulator [24]; (2) non-evaluative, auditory-visual feedback provided continuously using technology in a driving simulator [31]. Dogan et al. [24] suggested that a potential reason for not finding an effect of feedback in their study was due to the non-evaluative content of feedback, which did not highlight the reasons for participants' performance, or consequences for such performance and recommendations for improvement. In the study by Houtenbos et al. [31], the reason that feedback was not found to be effective may be because of the reduced sample size, as 8 out of 33 participants dropped out, and the use of non-evaluative feedback without specific guidance for young people to correct their performance was employed. In terms of the time of delivery, the immediate feedback was found more effective than continuous or delayed feedback. Some of feedback research is effective in improving individual performance, but each study employs different mechanisms of feedback, timing of feedback delivery, and feedback content. However, evidence suggests that immediate, evaluative feedback that provides consequences of behaviour (i.e., in terms of speeding) may be effective in improving performance and behaviour.

The effectiveness of feedback on performance depends on effective utilisation of feedback characteristics [13], including: content, source, medium of delivery, timing, and frequency. In previous studies all these characteristics have been examined with the focus on improving young drivers' speed management behaviour [36-36, 49, 50]. In fact, the most effective type of feedback (considering all feedback characteristics) in improving young novice drivers' performance in terms of speed compliance is feedback about performance, financial and safety implications (content), provided verbally and graphically (medium in which provided), by an instructor (researcher; source), immediately after the drive (time), once or twice (frequency).

To sum up, the effectiveness of feedback implementation largely depends on selecting the effective use of its components, including content, media, source, time, frequency. Each component should be researched in isolation to find out its effectiveness in a specific context. However, feedback is usually provided without specific research on "what works best". Instead, best practises, or previous research in educational or other contexts are used. This is done without consideration about specific differences in each context and subject area. Hence, if feedback was not effective, it is likely that one or several of its components were not utilised in the most effective way for the specific context.

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