

NOVICE DRIVER TRAINING WITHIN THE SOUTH AFRICAN NRSS 2016-2030

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ABSTRACT

Novice drivers, worldwide, have a significant risk of being fatally or seriously injured in a road traffic crash. South African statistics show that novice driver crashes (over a three-year period) represent approximately a tenth of all driver fatalities. As a signatory to the United Nations Decade of Action for Road Safety 2011-2020 (UNDoA), South Africa has pledged to halve road traffic crashes by 2020 from the 2010 baseline. To achieve a systematic reduction in road traffic deaths, the South African Department of Transport (DoT) published the revised National Road Safety Strategy (NRSS) 2016-2030. Developed and designed according to the principles of the Safe Systems approach, the NRSS aims to address the South African road safety problem by prioritising road safety interventions, ensuring appropriate allocation of resources and funds for the design and implementation of actions and strategies to address the dire road safety situation in South Africa. Evidence based research, needs to inform the type and direction of the interventions implemented. The NRSS mentions learner driver training only briefly and there are no clear guidelines on how to address novice driver training within the NRSS framework. This paper provides an overview of competencies acquired while learning to drive and makes recommendations for a more inclusive approach to address novice driver training in the quest for a safe road and traffic system.

1. INTRODUCTION

1.1. Background

Country crash statistics reported for the 2017 calendar year state that in the region of 14 050 people died on South African roads (Road Traffic Management Corporation 2018). The number of people killed on the roads per annum were 25.9 per 100 000 people (World Health Organization, 2018). The high number of road deaths is a cause of concern as it hampers social and economic development efforts in a middle-income country such as South Africa.

As a signatory to the United Nations Decade of Action for Road Safety 2011-2020 (UNDoA), South Africa has undertaken to halve the number of road deaths by 2020 from the 2010 baseline. Although some progress has been made this is not enough and an additional ten to fifteen years is needed to address the problem (Department

of Transport 2015). South Africa needs to meet the newly adopted 2030 Agenda for Sustainable Development, which sets the target of halving the global number of deaths and injuries from road traffic crashes by 2030 (World Health Organization 2018).

The Global Plan for the UNDoA sets out five pillars (safer vehicles, safer road users, safer roads and mobility, institutional management and post-crash care), according to which countries can align their safety interventions. The status of safety performances associated with these pillars is, however, still considered inadequate in developing countries such as South Africa (Small and Runji, 2014). These inadequacies need to be resolved systematically within the Safe System approach along with building institutional and human capacity of implementing agencies (Small and Runji, 2014).

To achieve a systematic reduction in road deaths, the South African Department of Transport (DoT) and the Road Traffic Management Corporation (the implementation agency of the DoT) published the revised National Road Safety Strategy (NRSS) 2016-2030. The NRSS 2016-2030 was developed according to the principles of the Safe Systems approach and aims to address the South African road safety crisis by prioritising road safety interventions to ensure the appropriate allocation of scarce resources and funds for the design and implementation of effective actions and strategies (Department of Transport 2015). The Road Traffic Safety Management System (RTSMS) is the basis of the Safe System and subsequently provides a framework against which the UNDoA actions can be completed and progress measured (Labuschagne' 2016). The Safe System approach encourages a holistic view of all factors in road safety as well as a better understanding of the interaction of the elements (road users, roads and roadsides, vehicles and travel speeds).

The Road Traffic Management Corporation (RTMC) State of Road Safety Report for the year 2017 highlights that the human factor is the contributory cause in 91 % of fatal crashes. Driver fatalities constitute approximately a third of South African road deaths with novice drivers accounting for approximately ten per cent of these deaths (Road Traffic Management Corporation 2018).

1.2. Problem statement

International research has, through the years, indicated that novice drivers are over-represented in fatal traffic crashes (Drummond, 1989; Oxley, Charlton, Starkey and Isler, 2014). Although some information pertaining to road users involved in fatal crashes in South Africa is available, details regarding the contribution of special road user groups such as learner, novice, elderly and disabled drivers to fatal crashes are not readily available. Pockets of South African research provide insight into some aspects of road user behaviour and although data collection and reporting efforts are improving, information about the role of human factors in fatal and serious crashes remain scarce.

As indicated above, it seems that South African novice drivers are part of the road safety problem in the country. Although the national road safety strategy makes provision for learner driver training, little is known about this group of drivers. In order for the strategy to successfully address the entry of new drivers to the road

network, knowledge about the target audience is an essential element of successfully implementing a strategy. In addition, driver training and education in South Africa is still an unregulated domain and the quality of driver education in South Africa is often questioned. By furthering the knowledge and understanding of the licensure learning process, novice driver research provides insight into behaviour that can facilitate changes to driver training policy, training methods, and testing methods.

1.3. Definition of “learner” and “novice” driver

Internationally, provisional drivers within graduated licensing programmes are drivers that hold temporary learner permits and who always drive under supervision, while novice drivers are “new to the road” and are in their first years of solo driving. Licensing ages range from sixteen to eighteen years depending on the country (Deery, Kowadlo, Westphal-Wedding and Fildes, 1999).

South Africa does not have a formal definition for a novice driver. In a critical review of the South African K53 system, Nkomonde (2005) defines “inexperienced drivers” as drivers between the ages 18 and 23 years of age, with no more than five years’ experience (Nkomonde, 2005). The National Road Traffic Act (NRTA) 93 of 1996 stipulates that a driving licence testing centre (DLTC) in accordance with the NRTA shall issue a licence authorising the driving of a motor vehicle; and shall be either: a provisional licence, known as a learner’s licence or a driving licence.

In the absence of a formal South African definition, for this study, “learner” or “novice” refers to a young, new, inexperienced or a beginner driver who holds a learner's driver permit. This group of drivers typically has little experience and this lack of experience could potentially contribute to higher risk of being in a fatal crash.

2. PURPOSE OF THIS PAPER

The purpose of this paper is three-fold. Firstly, the paper discusses the findings from a research project related to novice drivers carried out in Pretoria, South Africa utilising the naturalistic driving study methodology. Secondly, the paper provides an overview of novice driver training and the provision made thereof within the NRSS 2016-2030. Lastly, the paper makes recommendations for improvements pertaining to novice driver training in South Africa, in support of the Safe Systems approach.

3. OVERVIEW OF THE NOVICE DRIVER TRAINING PROJECT

3.1. Background

The CSIR and University of Stellenbosch have been actively promoting the use of Naturalistic Driving Studies (NDS) as a tool to understand the context of driving in South Africa since 2012. The most recent project focus was to explore novice driver hazard perception development during the K53 learner driver process.

3.2. Overview of the ND methodology

3.2.1. Data acquisition system

The NDS approach was used to observe learner driver behaviour in their natural driving setting over a period of 50 weeks. In January 2018, a data acquisition system (DAS) was installed in a participating driving school vehicle. The DAS consisted of three cameras. The first camera faced forward and collected image material of the road in front of the vehicle, while the back facing camera collected image material of the road environment at the back of the vehicle. The driver-facing camera collected image material from the novice driver. In addition, a computer box was connected to the vehicle and collected information regarding speed, coordinates from the global positioning system (GPS) of the vehicle on the road, acceleration and deceleration information. The information collected in real-time allows for the comparison of the image material, vehicle information (e.g. speed, vehicle position through GPS) as well as roadway data (e.g. road users, signage, and condition). The research team downloaded the naturalistic driving data (NDD) once a week for 50 weeks (large quantities of data to be collected in a ND study). The experiment strictly adhered to ethics stipulations from both the research ethics committees of the University of Stellenbosch as well the CSIR.

3.2.2. Recruitment of participants

The recruitment of learner drivers was done by the driving school instructor. At first contact (first lesson), each new learner driver was informed about the project, as well as the position and purpose of the cameras in the vehicle. The learner was informed about the confidentiality and anonymity clauses and the fact that the learner could, at any stage of the project, request to have his or her data removed from the data set. The driver instructor then issued each learner driver with a consent form and questionnaire to take home, to read and then decide whether they would like to participate. After consent was given, the learner driver was assigned a number by the driver school instructor. The questionnaire was returned during after a few lessons, when learners had acquired some driving experience, which was needed to answer questions

3.2.3. Description of participants

Of the 61 learner drivers, 53 gave consent to participate in the project.

This paper considers the analysis of the data for the first twenty five weeks and includes the analysis of driving data of the first twenty-six participants. Fifteen (58%) of the participants were male while 11 (42%) were female. Most novice drivers (85 %) were between the ages of 18 to 21 years. Four novice drivers (15% were between 22 and 30 years. On average, each novice driver:

- Attended 6 driving lessons
- Drove approximately 166 km during their training
- Spent 11 hours on driving training (parking and driving)
- Allocated 7 hours to practicing driving on the road.

For the purpose of the project, the driving instructor assessed and assigned a level of competence to each learner at the start of the training. The novice drivers participating in this project started their learner driver training with various levels of skill. Beginner drivers typically need to learn how to control the vehicle, while intermediate novice drivers (with some level of experience) progressed from handling the vehicle to starting preparations for the driving test. Advanced novice drivers typically had between one and four lessons, also in preparation for the K53 driving test. Most learners (table 1) fell within the level of skill (Level-of-skill2) group.

Level of skill	Male	Female
Level-of-skill 1 (Beginner)	4	1
Level-of-skill 2 (Intermediate)	8	9
Level-of-skill 3 (Advanced)	2	2
Total participants	15	11

4.2.4. Description of data and data analysis

The amount of data collected from the DAS, for twenty-six drivers, over twenty-five weeks are presented in table 2 below.

	Hours of data collected	Total distance travelled	Drive time	Time spent on parking
26 novice drivers	17211	4702	12127	5083

Each lesson was summarised, and the averages and totals compiled into a summary table that provides an overview of the demographics and driving data for each novice driver over 25 weeks. The date and time stamps were used to match the quantitative data (log files) and qualitative video data (.avi files) for each learner driver and for each individual trip.

Only driving practice data was analysed further in MaxQDA© qualitative software for to explore hazard perception development. The videos were coded in-vivo, and were a literature review to identify specific gaze behaviour associated with safe driving, as well as to select potentially hazardous situations or environments.

3.2.5. Exploring hazard perception development

In order to explore hazard perception development over the training period use was made of the first and last lesson data sets for each novice driver, summarised according to the road environment, and behaviour or actions associated with these road environments at the start and end of training. The data was cleaned and included the removal of codes that described behaviour in the parking area, as well as codes pertaining to the testing ground and training route.

The coded information from the front and driver facing cameras, were consolidated and matched with the vehicle information collected through the on-board computer. Summary sheets were prepared for each novice drivers and contained information regarding type of road environment, gaze behaviour, type of actions and average speed information.

The analysis of the NDD was done in Excel © (XLstat). For each dataset, a normality test was performed to provide an indication of the distribution of the data. The data sets did not follow a normal distribution and non-parametric tests were used to calculate P-values to highlight significant differences between gender groups, level of skill groups. In addition, differences within groups were explored as an indicator that hazard perception development is taking place over the course of the training.

From this data speed profiles were compared to explore whether there was:

- a difference in speed for first and last lesson
- differences according to gender
- differences according to level of skill

Secondly, the analysis took into account changes in the type and duration of gaze behaviour at the start and end of training. Changes in the type and frequency were considered the main indicator that hazard perception is developing. The gaze behaviours included:

- Fixation on the road
- Frequency and duration of other scan behaviour:
 - K53 – observations
 - Mirror use
 - Scanning blind spots
 - Scanning left and right

4. STUDY RESULTS

4.1. Overview of speed profiles

In general, the average speed maintained by novice drivers when driving was 28 km/h while the average maximum speeds were in the region of 66 km/h. The average speeds for the first and last lesson of all novice drivers were compared to understand if there was a difference in speed at the beginning compared to that towards the end of their training.

The expectation was that as novice drivers acquire more skill and experience, the more confident they would be to drive at higher speeds. Male novice drivers had a slightly higher average “normal” speed (23 km/h) compared to female novice drivers (22 km/h). Average maximum speeds recorded for males were 67 km/h and for females 66 km/h. No significant difference was found for average speeds during the first lesson. However, a significant difference was found between male and female drivers’ average normal speeds for the last lesson ($p=0.036$) indicating that in line with international findings, male novice drivers were more confident to drive at higher speeds towards the end of their driver training (Simons-Morton et al., 2005; Ivers et al., 2009). In terms of level of skill the expectation was that beginner novice drivers would drive more slowly than more advanced learners, however the finding was that average speeds seemed similar, but that maximum speeds of beginner drivers (Level-of-skill 1) were slightly higher than the rest of the novice drivers. The difference between groups was, however not statistically significant.

4.2. Changes in gaze behaviour: indication of hazard perception development?

4.2.1. Fixation on the road in front of the vehicle

Fixation on the road in front of the vehicle is a key characteristic of novice drivers as they tend to focus on where the vehicle would be on the road in a few seconds. This is important as this fixation means that the novice is not yet scanning the environment effectively for hazards from any other direction except from in front of the vehicle. During the first lesson, looking straight ahead (focusing on what is in

front of the vehicle) made up 88 % of the scan behaviour observed. During the last lesson “looking straight-ahead” constituted 69.1 % of scan behaviour observed.

A meaningful change was found for female participants on fixating on the road between the first and last lesson ($p=0.039$). This implies that female participants improved more than male novice drivers ($p= 0.539$) and subsequently started to focus on scanning the environment more effectively.

In terms of level of skill, for Level-of-skill 1 and Level-of-skill 2 participants the proportion of time allocated to scanning the road straight ahead increased rather than decreased between the first and last lesson. A significant difference was, however, found in the proportion of time allocated to scan straight ahead between Level-of-skill 2 and Level-of-skill 3 learner drivers. It would seem that beginner and intermediate novice drivers start to increasingly focus on the road in front and on keeping the vehicle on the road rather than scanning for unexpected or potentially adverse events. Advanced novice drivers, however, improved their scanning skills over time. This supports the notion that hazard perception develops over time and with experience.

A possible reason for this delay in skill development could well be the fact that novice drivers in South Africa are essentially training to pass their K53 driving test. This means that their focus is primarily on ensuring that their observations (mirrors, blind spots and 360 degree scans) are carried out systematically (i.e. in numerical order)

4.2.2. Changes in other gaze behaviour between the first and last lesson

Table 3 provide an overview of differences in scan behaviour (other than scanning straight) between the first and the last lesson.

Table 3: Change in % of time spent on gaze behaviour other than fixating		
	First lesson	Last lesson
Mirror use (general)		
Right side mirror use	0.60 %	0.70 %
Left side mirror	0.10 %	0.20 %
Rear-view mirror	1.0 %	1.40 %
	1.70%	2.30 %
Checking blind spots		
Blind spot left	0.30%	0.40 %
Blind spot right	0.20%	0.70 %
	0.50%	1.10 %
Broader scan behaviour		
Scan left	0.70 %	1.10 %
Scan right	3.0 %	2.70 %
	3.70 %	3.80 %
K53 driver test scan behaviour		
360 degree scan	0.60 %	2.30 %
Cross checks	0.50 %	1.20 %
8-12 second mirror scan	1.50 %	16.50 %

	2.60 %	20.00%
Project specific gaze behaviour		
Watch opposite traffic light turn amber	1.20%	2%
Look down (gear change)	2.50%	1.70%
	3.70 %	4.0 %
Total change	12.20 %	30.90 %

Grayson et al (2002) indicate that it is important to develop the ability to scan the road timeously and to have enough time to anticipate and appropriately react to risk situations in the road. In order to effectively scan the road for hazards, drivers need to make use of their mirrors, scan the environment both on the left and right side of the vehicle and check blind spots. Experienced drivers, in general, have wider scan abilities. As such the K53 driving test makes provision for specific observations (scan behaviour) that need to be successfully completed to pass the K53 driving test. As such learner drivers are required to conduct 360 degree scans of their environment when moving from a stop position, to cross check oncoming traffic from arterial roads as well as scan mirrors every 8-12 seconds.

An improvement in the proportion of time allocated to other scan behaviour was observed for all types between the first and the last lesson. However, as can be seen from Table 3 the most significant change in gaze behaviour (other than fixation) was for the K53 observations, most notably for scanning mirrors every 8-12 seconds.

In addition, in this project two additional gaze behaviours were coded. These were a) watching the opposite traffic light turn to amber, and looking down to change gears. "Watching the opposite light turn to amber", assisted novices with starting their preparation to do their 360 degree observations before pulling away from the traffic light. Looking down to change the gears is associated with the level of skill. Beginner drivers tended to look down more frequently and for longer periods of time compared to intermediate and advance novice drivers who were more confident controlling the vehicle. The fact that the proportion of time decreased is therefore positive as it indicates that novices were becoming more competent in controlling the vehicle between the first and last lesson.

4.2.3. Discussion of results

Learning to drive is a complex task that requires novice drivers to learn to anticipate and appropriately react to events in the road and traffic environment. The slow average speeds at which novices drive during training is testimony to the highly controlled environment in which learner driver training takes place. Novice drivers are under constant instruction and, although the instruction through the course of the training sensitizes novices towards hazards in the road environment, hazard and risk perception is not the main priority of the K53 system. Instead, focus is on passing the test, i.e. on completing the K53 driving test successfully.

Despite the controlled environment, there are indications that novice drivers are developing hazard perception skills and are indeed learning to anticipate and react to hazardous situations in the road environment. This study found that situational awareness and hazard perception improves marginally during training, and that it is correlated with experience, over time. Despite evidence that these higher order skills are developing, novice drivers are not yet able to adequately and efficiently scan and

react to hazards in their environment. The conclusion is that the K53 teaches control of the vehicle and compliance with road rules and regulations, rather than teaching safety.

In comparison with similar prescribed driver training programmes used for preparation of learner drivers elsewhere, the current K53 manuals (Department of Transport 2012) fall significantly short of providing an adequate emphasis on safety and its importance in the driving context. The Australian learner driver manual for New South Wales (NSW), for example provides a detailed, 2-chapter background into safety; which explains what constitutes safe driving and highlights the global and local impacts of driving that is unsafe. The learner driver in NSW is left with a clear understanding that safety is the primary goal of learner driver training, and that safety is their main responsibility as a driver in the future (New South Wales Government 2019). In contrast, the South African learner manuals mention safety as a secondary consideration in specific situations, rather than making safety a priority.

5. NOVICE DRIVER TRAINING WITHIN THE NRSS 2016-2030

5.1. Overview of novice driver training in the NRSS

The NRSS addresses novice or learner driver training under two of the UNDoA pillars namely institutional (Road Safety) Management and Safer Road Users. Under Pillar 1 (Road Safety Management), the NRSS highlight the importance of driver training and the important role that driver training plays in road safety. The strategy notes that the learner driver sector is subject to changes in technology, vehicle design, changing road designs as well as changing behavioural patterns. In addition, the strategy recognises that the K53 driver training programme is out of date and that from a road safety management perspective an improved solution is needed to address driver training in the country. An issue is the fact that the sector is largely unregulated and that this shortcoming needs to be addressed in order to produce safe new drivers (NRSS, 2015: 29). Under Pillar 4 (Safer Road Users) reference is made to the outdated K53 driver training which does not make provision for road safety prevention elements (NRSS, 2015: 30). As part of the strategic themes that need to be addressed in the interim, mention is made of a revised driver training and testing process. Proposed solutions to ensure safer new drivers include the development of a strategy to regulate driving schools, to implement alternative licensing methods as well as the introduction of periodic driver retesting. Lastly, to investigate the value of introducing driver training at school based graduated learner driver programmes to enable learners to acquire drivers' licensing together with their grade 12 or technical and vocational qualifications (NRSS, 2015: 52).

The issues that need to be addressed within the NRSS, are longstanding and little progress have been made, over the years. Part of the problem is the fact that South Africa has little scientific research pertaining to novice drivers that can inform and support the proposed solutions. Knowledge about a target audience is an essential element of successfully implementing a strategy.

5.2. Recommendations to improve novice driver training in South Africa

Learning to drive is a multifaceted process and South African novice drivers need to become skilled at not only controlling and manoeuvring the vehicle, building confidence and experience over the course of learning period as well as becoming situationally aware of risk within the driving environment.

The quality of novice drivers is a product of the traffic management system and relates to the training and education of the novice driver. No compulsory training requirements or restrictions to learning to drive exist in South Africa at present. Considering the controlled environment in which South African novice drivers are being taught, it might not be unreasonable to argue that the intent of current K53 learner driver training in South Africa is not about preparing novice drivers for future risk on the road, but for successful completion of the K53 driving test.

Within the NRSS, provision has been made to investigate not only the regulation of the driving school industry but to explore the value of introducing driver training at earlier stages (e.g. in secondary schools). This study supports this proposed course of action as currently driver training remains unregulated in South Africa. While the regulation of driver training does not have a direct bearing on this study, it does influence the quality of learners entering the system, as well as the quality of the driver training that they receive. It is unfortunate that the cost of driver training (not all young drivers are able to afford driver training) inevitably influences the quality of training. The findings relating to the differences in level of skill observed among the participants in this study is an indication that it is often more affordable for students to begin learning on their own before paying for professional training. While this makes economic sense, students 'learning on their own' opens the door to poor or misguided driving practices which would be difficult to erase down the line. By standardising learner drivers' training and education as part of a school-based curriculum, it becomes possible to make standardised training more accessible to all South African novice drivers.

Secondly, the NRSS mentions that there is a need to revise the current driver training process and even the introduction of new measures to improve the quality of drivers on South African roads. Internationally, use is made of graduated licensing systems (GDL) where learner drivers continue to drive under supervision until they have met the prescribed requirements to drive safely under specific adverse conditions. This process can take up to three years before a learner can become a fully licensed driver. The controlled 'learner driver' environment in which South African novice drivers learn to drive, provides little or no additional opportunity to drive in potentially dangerous circumstances such as during the night, with passengers and so forth.

Previous calls have been made to introduce a hazard perception test before and during learner driver training. This research supports this call as the current K53 training regime makes little provision for novice drivers to develop these important skills as part of their training.

6. CONCLUSION

The rate at which motorised traffic is growing, and at which new drivers are admitted to the road and traffic system, have serious implications for the number of traffic

deaths in the Country. Crash statistics for the three-year period 2015 to 2017 indicate that novice drivers of 18 to 25 years of age represent approximately 10 % of all South African fatal traffic deaths. This warranted an investigation into factors associated with novice drivers' crashes, to curb the occurrence thereof.

Learning to drive is a complex task that in addition to ensuring the vehicle is kept on the road requires novice drivers need to anticipate and appropriately react to events in the road and traffic environment. Driver training and education need to ensure that newly licensed novice drivers who prepare to exit the learning environment and enter the road network are competent, and situationally aware of the driving environment, when starting to drive solo.

This naturalistic driving investigation explored hazard perception development based on demographic and driving data collected from 26 South African novice drivers over a 25-week period. The results indicated that although changes were detected between the first and last lessons, the largest change was for scan or gaze behaviour associated with K53 requirements. The conclusion was that the K53 driving test currently does not specifically support the training of safe drivers, but rather training of learners to successfully pass their driving test. Unfortunately this means that as a country we are not necessarily facilitating the entry of safe novice drivers to the road network.

This study results therefore motivates the urgent need to re-evaluate the current training and testing practices of new novice drivers in the country.

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Passenger Influence on Driver Safety

In NSW **14%**
Recent research suggests that at least of all road crashes involve the driver being distracted by something inside or outside the vehicle.

Distractions from within vehicles account for over a third of these 'distraction' crashes.

Young drivers have a higher crash risk when travelling with passengers of similar age than when travelling alone.

Any distraction that takes attention away from the driving task significantly increases the chances of becoming involved in a crash.

When drivers are distracted or their attention is divided, they are more likely to make mistakes.

The biggest distractions inside the vehicle are:

- OTHER PASSENGERS
- ADJUSTING THE SOUND SYSTEM

TIPS FOR PASSENGERS

Passengers can reduce distractions by

- o Adjusting the radio, digital music devices, or load CDs for the driver
- o Never encouraging a driver to drive dangerously
- o Keeping the noise down
- o Alerting the driver to external hazards (pedestrians, speed limit change, road works, etc)

Reducing distractions means reducing the crash risk.

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