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"Goals for Driver Education" Model as a Guide for Safe Driving Education and Training in Algeria

El modelo GDE (Objetivos para la Educación Vial) como guía para la educación y la formación en materia de conducción segura en Argelia

Adel Touil ¹

Abstract: This essay provides a conceptual and methodological framework based on self-assessment of safe driving skills as an educational strategy to improve the quality of road safety education in Algeria. It aims to improve and develop the current program by adopting the content of the GDE model, which has proven its effectiveness in the field of traffic safety. Its monitoring allows the implementation and evaluation of procedures, policies, and programs, particularly those that focus on high-level driving skills. In Algeria, road safety education is included in school curricula from the primary level (around six years of age) and continues through middle and secondary education, with the aim of instilling a culture of road safety and promoting positive behavior on the road. At the conceptual level, this work calls for the need to shift the concept of road safety education towards more effective and comprehensive concepts compared to current programs that rely mainly on procedural skills training. At the methodological level, the GDE model proposes teaching driving according to a hierarchical sequence that progress from learning basic skills to high-level driving skills. It serves as a basis for designing a driving education program based on an integrated theoretical framework and scientific background, and for directing the educational process, identifying and activating relevant strategies and indicators. This should be prepared according to a scientific methodology, and is hoped to serve as an effective tool in addressing the traffic phenomenon.

Key words: driver education, GDE model, safe driving, driving skills.

Resumen: Este ensayo proporciona un marco conceptual y metodológico basado en la autoevaluación de las habilidades de conducción segura como estrategia educativa para mejorar la calidad de la educación vial en Argelia. Su objetivo fue desarrollar el programa actual a través de la adopción del modelo GDE, que ha demostrado su eficacia en seguridad vial. Su seguimiento permite la implementación y evaluación de procedimientos, políticas y programas, particularmente aquellos que se centran en las habilidades de alto nivel. En Argelia, la educación vial se incluye en los planes de estudio desde el nivel de primaria (seis años) y continúa durante la educación media y secundaria, con el objetivo de inculcar una cultura de seguridad vial y promover un comportamiento positivo en la vía. A nivel conceptual, este trabajo plantea la necesidad de reorientar el concepto de educación vial hacia conceptos más eficaces e integrales en comparación con los programas actuales, que se basan principalmente en la formación de habilidades procedimentales. A nivel metodológico, el modelo GDE propone la enseñanza de la conducción según una secuencia jerárquica que progresa desde el aprendizaje de habilidades sencillas hasta las habilidades de conducción de alto nivel. Este modelo constituye el fundamento para el diseño de un programa de enseñanza de conducción sustentado en un marco teórico integral, para dirigir el proceso educativo, identificando y activando estrategias e indicadores relevantes. Este documento debe elaborarse siguiendo una metodología científica y se espera que sirva como una herramienta eficaz para abordar el fenómeno del tránsito.

Palabras clave: educación vial, modelo GDE, manejo seguro, habilidades de conducción.

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1. Introduction

Driving is a complex routine task that requires the coordination of a variety of sensory, motor, cognitive and psychological knowledge and skills, and its performance requires a positive interaction between the components of the traffic system: driver, vehicle, and environment (Santos et al., 2014, p. 301). To ensure positive interaction between the components of the traffic system in its dynamic state, ergonomic principles must be applied when designing the vehicle and the environment, developing safe driving skills among drivers taking into account their limited psychological and physiological capabilities. Safe driving is related to the driver's ability to control the vehicle and deal with various traffic situations efficiently, effectively and safely, and adopt safe driving behaviors that ensure his safety and the safety of other road users. In order to enhance safe driving practices among drivers, since they are the most representative and exposed group to traffic accidents in Algeria and the entire world, it is necessary to develop their safe driving skills by improving the quality of education provided to driving learners, as well as ensuring the optimal planning for the post license phase, by accompanying beginner drivers while driving and developing the necessary materials and human means to conduct the educational process to achieve the desired goals.

Road safety education is a fundamental component in promoting safe driving, as it helps develop responsible and conscious behavior from an early age. In Algeria, this education has been integrated into school curricula since the primary level (around six years of age) to foster awareness of traffic rules and strengthen the culture of law compliance. This approach aligns with the principles of the GDE model, which emphasizes early education and the development of cognitive and behavioral skills necessary for making safe driving decisions, an essential step toward reducing road accidents and improving overall traffic safety.

The concept of driver education and training aim to provide drivers with a set of procedural knowledge and skills related to driving, and to develop awareness of how their individual and collective characteristics can direct their behavior towards adopting the principles of traffic safety and security. Ashleigh et al (2013) revealed that the main reason why drivers are involved in a large number of traffic accidents is not due to their weak procedural driving skills as much as it can be attributed to the neglect of high-level cognitive skills.

Varieties of driver education and training methods have been developed and different strategies have been applied to reduce the driver's involvement in traffic accidents in several countries including the United States of America and Australia. However, most of them focused

on teaching basic driving skills, and dealing with common and frequent traffic situations that a driver may encounter (Gregersen, 2004, p. 8).

In the early 1990s, a new theoretical model for driving behavior known as the “Goals for Driver Education (GDE)” model was proposed by a group of European researchers, with the aim of reducing the driver’s exposure to risks and their accident involvement, by teaching and training various competencies and skills necessary to ensure their safety and the safety of other road users as much as possible.

The GDE model has proven effective in several European countries: Sweden, Finland and Denmark, where it has contributed to developing training standards for trainees and instructors and has contributed to directing driving license tests to develop students’ self-assessment of driving skills (Boccaro, 2014, p. 120). Norway, Finland and Sweden share an interest in how to implement GDE levels in driver education systems due to the common basis of these driving education systems in adopting the GDE model as a reference in driver education and training.

In this context, the GDE model and its multiple strategies come to facilitate the educational process for both the teacher and the learner. The hierarchy that the matrix came up with includes all the safe driving skills that a safe driver needs. Compared to current driver education programs that focus on training certain maneuvers, we can say that the driving task is more than just “mechanical operation”, and that the main goal of driver education and training is to create drivers who have the necessary skills and awareness to ensure their own safety and the safety of other road users.

This essay aims to provide a conceptual and methodological framework that enables us to reconsider the driver education and training system from a perspective that goes beyond traditional models and adopts modern models that focus on advanced high-level driving skills (mastery of traffic situations, risk perception, self-awareness of road hazards). This can only be achieved by improving the quality of education provided to learners and developing the strategies and tools used in teaching the content of training programs, ensuring that educational needs are met and efficiency is ensured.

At the conceptual level, this article provides a comprehensive overview of the Algerian traffic system and the reality of driver education and training. It highlights the need to direct training towards achieving a high level of efficiency, with an emphasis on the cognitive, skill, and behavioral aspects of the driver. It discusses the concept of GDE and its importance as a training program and educational strategy for achieving safe driving. This model focuses on the

learner's needs and abilities and encourages continuous self-assessment of driving skills, ensuring that training is appropriate to the learner's level. It also encourages learners to understand the influence of their personality and beliefs on their driving style, helping them develop safer driving behaviors. It has proven effective as a guide for driver training and testing in Norway as a traffic safety measure to reduce traffic accidents among drivers, which has enabled the control of traffic phenomenon. Finally, the following dimensions are proposed: (vehicle control and manoeuvring, mastery of traffic situations, self-awareness of road hazards), as key axes in building a comprehensive and effective training program.

Furthermore, at the methodological level, it is proposed to use the GDE model as a reference for developing educational programs and as a tool for guiding the educational process, identifying relevant strategies and indicators, and implementing them across the components of the traffic system, including driving schools, driving instructors, adopted strategies, and used tools. This model should be designed according to a scientific methodology and implemented according to a hierarchical sequence that progresses from learning simple skills to higher-level skills.

This proposal seeks to highlight the challenges facing the Algerian traffic system in adopting the GDE model in the field of driver education and training to improve the quality of driving education and meet the educational needs of driving learners, or as a complementary program for experienced drivers, especially in light of the increasing number of traffic accidents and the material and human losses they cause.

2. Development of the topic

2.1. Proposition

The current driver education and training program in Algeria focuses on teaching traffic rules and basic driving skills to deal with common traffic situations that a driver may encounter. It focuses more on knowledge and skills related to the procedural skills of the operative and tactical level, while less emphasis is placed on risk avoidance and self-evaluation skills related to the strategic level of driving behavior.

Various strategies have been applied to reduce drivers' involvement in traffic accidents of which is: strict penalties, awareness and sensitization campaigns, increasing the number of driving hours to pass license exams. However, these strategies have proven ineffective in resolving the traffic problems. According to Rahali (2015), the majority of drivers change their driving style compared to what they have learned, remember little from training and testing, and

do not apply the safety knowledge and skills they have acquired during training, which has contributed to the exacerbation of the traffic phenomenon.

According to Touil's study (2023), the National Center for Road Prevention and Security (2018) revealed the registration of 25,038 traffic accidents during the year 2017, which resulted in more than 3,639 deaths and 36,287 injuries. The same source also confirmed that about 96% of the recorded accidents were caused by human factor, and that young novice drivers between the ages of 18 and 29 constitute the highest category that caused these accidents. In the same context, the National Road Safety Delegation revealed in (2022) the registration of 18,949 physical traffic accidents during the year 2021, which resulted in more than 3,061 deaths and 29,000 injuries, and attributed this to the weak level of training of drivers to pass the driving license exams (Touil, 2023, p. 7).

As previously mentioned the GDE model has been widely used in driver education and training in European Nordic countries, particularly Norway. Its concept has been widely referred to, either explicitly or implicitly. The matrix represents a conceptual framework for the objectives of driver education and training and a theoretical reference tool for experts working in the field of driver education.

The GDE model framework identifies the components to be addressed in driver education and training programs within a hierarchy ranging from basic vehicle operation skills to higher cognitive skills, according to the following hierarchy: vehicle control and maneuvering (operational level), mastery of traffic situations (tactical level), driving goals and context (strategic level), goals for life and skills for living (general level) (Bates et al., 2013, p. 1).

In the field of driver education and training in Algeria, the focus remains on teaching procedural skills only, while some research has revealed that the main reason for drivers' involvement in traffic accidents to the neglect of higher cognitive skills as was concluded in Touil and Salhi's study (2023), this trend is most clearly evident in the number of traffic accidents recorded and the resulting daily material and human losses.

In this context, the poor quality of the traffic system not only complicates the process of its continuous monitoring and evaluation, but also the implementation of effective policies in the field of driver education and training, which in turn exacerbates the traffic phenomenon, especially among young novice drivers. Therefore, ensuring the quality of driver education and training is of paramount importance. Based on this hypothesis and to address this problem, the researcher proposes a reconsideration of the currently adopted system and strategies in accordance with the content of the GDE model.

This essay aims to present a theoretical and methodological proposal for how to address educational and training needs through three main axes (vehicle control and manoeuvring, mastery of traffic situations, self-awareness of road hazards), Combining these elements provides a comprehensive vision for creating a comprehensive and effective driver education and training system that ensures all candidates have the opportunity to acquire the necessary competence and awareness to ensure safe driving.

A preliminary methodological approach is proposed based on the GDE model, which has proven effective in leading countries in the field of traffic safety, most notably Norway, which, thanks to this model, has been able to control the traffic phenomenon. Thanks to this model, it has been able to control the traffic phenomenon, especially since Algeria currently lacks a system that allows for comprehensive monitoring of the quality of driver education and training. Therefore, this proposal constitutes a fundamental basis for its construction.

2.2. Arguments for discussion

2.2.1 *Driving education and training: measures to improve road safety and developing safe driving skills*

Driver training and driver education are two distinct and related concepts. “Driver training refers to the teaching of procedural and/ or cognitive driving skills with specific objectives, such as obtaining a license or learning particular skills” (Bates et al., 2013, p. 7). However, driving education is broader and more comprehensive than training and is less limited. It includes teaching various topics related to safe and responsible driving in a comprehensive manner, such as the rules of the road, road safety, risk and dangerous traffic situations, the influence of personal characteristics on driving behavior, and it encompasses everything it includes training (Fleiter et al., 2013, p. 47).

Road safety education is a key component in promoting road safety, as its role extends beyond teaching traffic rules to developing learners’ awareness of traffic hazards and their ability to make safe and responsible driving decisions in various road situations. In Algeria, road safety education is incorporated into school curricula from the primary level (at the age of six), where early education helps instill positive habits from a young age and establishes a strong cognitive and behavioral foundation that can be built upon in subsequent middle and secondary education. By adopting the GDE model, which emphasizes early education, the development of cognitive and behavioral skills, and safe decision-making, driving skills are taught hierarchically, starting from basic skills and progressing toward advanced competencies. This

approach facilitates the evaluation of educational programs and guides future policies and programs to enhance road safety in the long term.

A range of theoretical approaches is applicable in the field of driver education and training. However, it has been argued that one of the reasons why many driver education strategies have been ineffective in reducing crash risk is their lack of a solid theoretical basis for modifying young drivers' behaviour and behaviour modification in general (Schulte, 2014, p. 10). Therefore, it is necessary to provide the knowledge and skills required to develop safe drivers, along with the motivation to apply these skills in actual road driving.

The real goal of driving education is to provide drivers with the necessary skills to become safe users once they obtain their driving license, either as an individual procedure or in combination with other procedures such as the graduated licensing system. The concept of driver education and training refers to providing drivers with a set of procedural knowledge and skills related to driving, in addition to developing awareness of how their individual and collective characteristics direct their behavior towards adopting the principles of traffic safety and security. Ashleigh et al (2013) revealed that the main reason of drivers' involvement in a large number of traffic accidents is not due to their weak procedural driving skills as much as it can be attributed to the neglect of high-level cognitive skills.

According to Touil and Salhi's study (2023), the driver education and training program in Algeria focuses mainly on teaching the basic skills necessary to drive a vehicle safely, while ensuring mastery of traffic rules and mastering the basic maneuvers to control the car in common traffic situations in order to avoid the driver being exposed to dangerous traffic situations and avoiding being exposed to traffic accidents, which was confirmed by the results of the study conducted by Boudrifa (1991). In this context, most researchers and specialists in the field of traffic security and safety attribute the reasons of driver's involvement in most traffic accidents to the weak level of education and training programs in driving schools, and their lack of material and human capabilities.

Touil and Salhi (2023), attributed the increase reason in traffic accidents in Algeria to the weakness of the field of driver education and training. In the context of driving, it is a matter of becoming aware of the various factors that have an impact on driving, and the importance of the driver's actions and motivations in this process, including the driving context, personal preferences, dealing with various traffic situations, planning for driving, and life in general (Peräaho et al., 2003, p. 14).

To reduce the major consequences of traffic accidents that threaten the safety of the driver and society, several solutions have been implemented in Algeria in order to achieve the maximum traffic safety conditions, by conducting awareness campaigns using: media, guidance and awareness programs, and educational sessions that address the traffic problem, in addition to the role played by other institutions such as the Ministry of Transport, the National Center for Prevention and Road Safety, and security institutions that work to strictly implement the procedures stipulated in the traffic law, but these strategies have proven ineffective in solving traffic problems, which necessitated a review of the content of the national driving and training program and the strategies followed in its implementation.

The Algerian driver education system places greater emphasis on knowledge and skills related to the operational and tactical aspects of driving, while comparatively less importance is given to risk-prevention and self-evaluation skills associated with the strategic and personal levels of driving behaviour.

2.2.2 Driver competence in a hierarchical perspective and implications for driver education

The matrix first appeared in the early 1990s in Finland, where Keskinen and Hatakka designed a new theoretical conception of the driving task “Driver Training Objectives from a Psychological Perspective” (Schulte, 2014, p. 10). This model focused on linking driver education to the psychological and cognitive goals of the driver, rather than merely observable behaviors on the road. The hierarchy developed by Keskinen shows many similarities with Michon’s hierarchical model; however, the main difference lies in Michon’s goal-oriented perspective, whereas Keskinen and Hatakka’s model emphasizes the descriptive perspective of behaviors and situations associated with those goals.

What is also important is adding a fourth level related to life goals and living skills: (Tronsmoen, 2011, p. 12)

- Level 1 (operational level): vehicle control and maneuvering
- Level 2 (tactical level): mastery of traffic situations
- Level 3 (strategic level): driving goals and context
- Level 4 (general level): goals for life and skills for living

This fourth level allows driving to be understood as part of a broader process of personal, social, and cognitive development, emphasizing that driver education is not limited to technical skills but also includes the formation of balanced and responsible behaviors in daily life.

However, a safe driver is not just a highly skilled driver, but also aware of his or her abilities, individual characteristics, and risks (Rodwell et al., 2003, p. 2). The hierarchy has been expanded into a matrix in order to cover these different dimensions, which in addition to the four levels includes three dimensions: (Corneloup, 2019, p. 25)

- Knowledge and skills: what a driver needs to know at each level so that he can drive the car safely and deal with unusual traffic situations in a safe manner.
- Risk increasing factors: factors that increase or decrease risk.
- Self-Assessment: being aware of personal circumstances and tendencies, abilities and skills related to maneuvering, traffic handling, driving planning, and life as a whole.

Later, this four-level was complemented with a fifth level "social and economic pressures" presenting the culturally directed or affected level of behaviour (Sarolta, 2016, p. 3824). By incorporating this level, the model provides a more comprehensive understanding of driving behavior, acknowledging that drivers operate within a broader social and cultural context. Consequently, the expanded model aligns closely with the principles of Michon and Keskinen, highlighting a hierarchical yet integrated approach: from basic vehicle control skills to higher-level decision-making influenced by personal goals, life skills, and ultimately the social and economic environment.

The GDE model is an educational and conceptual framework that defines the factors and foundations that must be considered for driver education and training, it describes the driving task as a hierarchy summarizing the competencies that a safe driver needs. The idea of the hierarchical approach is based on the influence of levels on each other, and requires that capabilities and conditions at higher levels affect the driver's behavior and decisions at the lower levels.

The GDE model is a theoretical framework developed to improve the effectiveness of driver education and training programs. It focuses on a wide range of factors that may influence young people's driving and thus increases the scope of what is included in driver education and training. These factors are grouped into five hierarchical levels and three types of individual competencies, Creating 15 aspects that the ideal driver training approach should address, as shown in Table 1:

Table 1
GDE (Goals for Driver Education) model Contents.

	Knowledge and skills	Risk-increasing factors	Self-evaluation
Level 5 (social and economic pressures)	Knowing how social and economic pressures affect driving behavior (Cultural, subcultural, Social issues, Group goals, values and motives...)	factors impacting on driving (social, economic and group pressures)	Increasing awareness of how social, economic and group pressures affect driving behavior, judgements and choices.
Level 4 (Personal goals for life and skills for living)	The individual's life goals and personal tendencies, his motivations as well as the influence of lifestyle/age-related issues and personal values.	Dangerous motives and risk-increasing aspects of lifestyle and personality, personal motivations, good impulse control leads to less rash decision-making.	Increasing awareness of the behaving way, attitudes towards risk, and Personal skills for impulse control...
Level 3 (Goals and context of driving)	Understand the importance of planning in making safe and economical trips...etc. Determining how to get to the intended destination safely at the lowest possible cost.	Factors related to poor or lack of planning, if the driver is fully aware of the personal goals of driving, he can plan and prepare to face potentially difficult situations when faced with them.	Give a realistic picture of his personal motivations for driving. Make him fully aware of the safe driving alternatives available when making travel-related choices.
Level 2 (Mastery of traffic Situations)	How to manoeuvre the car, how to drive in traffic and what rules must be followed and how they shall be followed.	Factors that increase risks, due to misuse of the vehicle and dealing with various traffic situations in the necessary and required manner.	All about observational skills, planning and anticipation, Personal driving style and safety margins.
Level 1 (Vehicle control and Manoeuvring)	What a driver needs to drive under normal circumstances, Master basic maneuvers and control the vehicle and its various systems safely.	Risks resulting from misuse of the vehicle and its various systems.	Strengths and weaknesses regarding basic vehicle control in various traffic situations

Source: Own elaboration, 2025.

The first level aims to teach the operational knowledge and necessary skills to control the vehicle automatically and safely. The learner must be fully aware of how the vehicle is manoeuvred, its construction, its different subsystems, and how they can be used in the best

possible way, the risks resulting from their misuse, also know how to make a realistic assessment of his skills and abilities:

- Knowledge and skills related to: how to start, change gears, legislation related to vehicles and their various equipment, safety systems and equipment... knowledge of car characteristics(the effect of natural laws on car dynamics, tires and friction, reducing skids on low friction, understanding the laws of physical forces), using the vehicle's control tools (steering wheel, pedals ...etc.), operating additional devices (lights...), safety systems and equipment (braking systems, seat belts...etc),and mastering basic maneuvers (starting, changing speeds, braking, changing direction...etc)
- Risk increasing factors related to :technical faults resulting from negligence of vehicle maintenance and insufficient tire pressure, worn-out tyres, insufficient control skills, lack of automatism in performing basic manoeuvring, poor brakes, misunderstanding of vehicle dynamics, Inappropriate speed adjustment, driver reactions, failure to use seat belts and safety devices, blind spots...etc
- Self-evaluation :to create links between education and the results of this education, by making the driver aware of the car dangers as a machine and the limitations of his ability to control it, while enhancing his ability to think about how to deal with it. By asking a set of questions such as: why am I doing this, this way and not that way, what did I do to make the car drive like this, focusing on skills that the learner finds difficult to learn or feels insecure to practice, also the maneuvers that he finds very easy to perform to avoid developing the of overconfidence problem (Peräaho et al., 2003, p. 32).

The second level aims to enable the driver and develop his knowledge to deal with various traffic situations efficiently, effectively and safely, so that he must be able to adapt his/her driving in accordance with the constant changes in traffic road conditions, in different situations and under different circumstances, and be able to expect the other road users behaviors and adapt his driving style according to their expectations.

- Knowledge and skills: knowing and respecting traffic rules and laws, adjusting the vehicle speed in different traffic situation, safety distance, anticipation, hazard perception and driving with safety margin , anticipating the behavior of other road users and adapting his driving style according to their expectations (using various traffic signals), dealing with their mistakes.
- Risk increasing factors related to : the non-compliance with traffic rules and laws, overconfidence and lack of confidence, poor speed control, insufficient safety margins,

difficult driving conditions, road conditions and bad weather conditions, darkness, poor visibility, insufficient spontaneity, other road user's behavior (drivers, pedestrians, cyclists, children), poor risk perception, poor monitoring, wrong expectations, insufficient knowledge of typical accident scenarios, risky driving style...etc.

- Self-evaluation: provides an opportunity to give the learner a realistic picture of his strengths and weaknesses with regard to various aspects of driving. It also provides an opportunity to evaluate driver motivations and behaviors at higher levels, by directing his focus to situations he find difficult to deal with efficiently or safely, and being aware of the consequences of his different decisions and actions.

The third level aim to provide the driver with necessary knowledge about safe and risky alternatives when drivers are making trip-related choices (Gregersen, 2004, p. 12). In order to plan a good trip, Assailly (2009) suggested that the driver must ask a several questions about the trip, the most prominent of which is: Why? Where? When? How? With.

- Knowledge and skills: determining the route, available travel options (individual or group, car or bus), travel time (day, night), seasonal differences and weather conditions (snow, ice, rain...), determining the appropriate speed in relation to the total travel time and fuel consumption, time pressure...etc, the effect of social and personal pressures on driving (alcohol, stress, fatigue, driving motivations...etc).
- Risk increasing factors: risks at this level can be addressed through problem-solving exercises and self-assessments that will make learners think about factors that affect trip planning (lack of knowledge of: the car, the road and driving environment, drunk driving, distraction ,peer pressure, social context, stress, nervousness).
- Self-evaluation: this axis focuses on the technical skills before the trip: determining the goals and motivations of driving, awareness of personal factors related to trip planning, awareness of strengths and weaknesses related to personal planning skills, personal motivations and general life goals.

The fourth level: aims to understand how various personal and social preconditions affect an individual's role as a driver, understand how factors such as: (age, gender, personality, lifestyle, socio-economy, education, and peer groups) are related to driving behaviour and accident risk involvement, understand the relations between driving behaviour and individual, social and cultural aspects of life:

- Knowledge and skills related to driver's motivations and goals, habits and lifestyle, disability and special needs, cultural level and social status, age and gender, personality, general values and attitudes, intelligence, education and learning style , Diseases and abilities, group norms and peer pressure, lifestyle, socio-economic position.
- Risk increasing factors associated with life projects, values, behavioral style, social pressures, drunk driving and drug use, seeking, impulse control, overconfidence and under-confidence, self-enhancement, and compliance with social pressure, poor attention levels, poor visual ability and other physical and mental disabilities ...etc
- Self-evaluation: is concerned with the issue of increasing awareness of things that are usually not subject to scrutiny, such as the way of behaving, attitudes, behavior motives... For example, the learner must understand how group pressure develops and how it affects his personally, and must realize that his goals and motivations in life outside the traffic environment influence his behavior in traffic as well.

The fifth level concerns the skills a driver needs to assess and manage "social and economic pressures and influences" and their effects on increasing risk. (Corneloup, 2019, p.26). Nieminen and Susimetsa (2018) sees traffic as a social environment in which the driver interacts with the rest of the road users, the identity of the group in which the individual lives plays a major role in shaping goals, and the personal values of the driver. The most important aspects related to this level:

- Knowledge and skills related to knowing how social and economic pressures affect driving behavior: social and cultural influence, the media influence, the working influence conditions, legislation and enforcement, societal values and standards, the influence of values and norms...etc
- Risk increasing factors related to social groups and their values and standards, the influence of the media, peer pressure, the influence of society's values and standards, work-related stress, lack of clarity and acceptance of traffic safety measures...etc.
- Self-evaluation relates to increasing awareness of how social, economic and group pressures affect driving behavior.

2.2.3 The importance of driver education and training according to the GDE model as an evidence-based intervention and its contribution towards road safety

The advent of the GDE model shed light to the traditional focus of driving education on control and mastering common traffic situations and shown that it is only a small part of what actually constitutes the result: driver behaviour. Moreover, he emphasized the necessity of combining procedural skills with high-level cognitive skills, as they provide a comprehensive conceptualization of the driving task and the content of driver education, including motivational factors and the transmission of values and attitudes. The importance of the matrix in the field of driver education and training to ensure traffic safety and security is as follows:

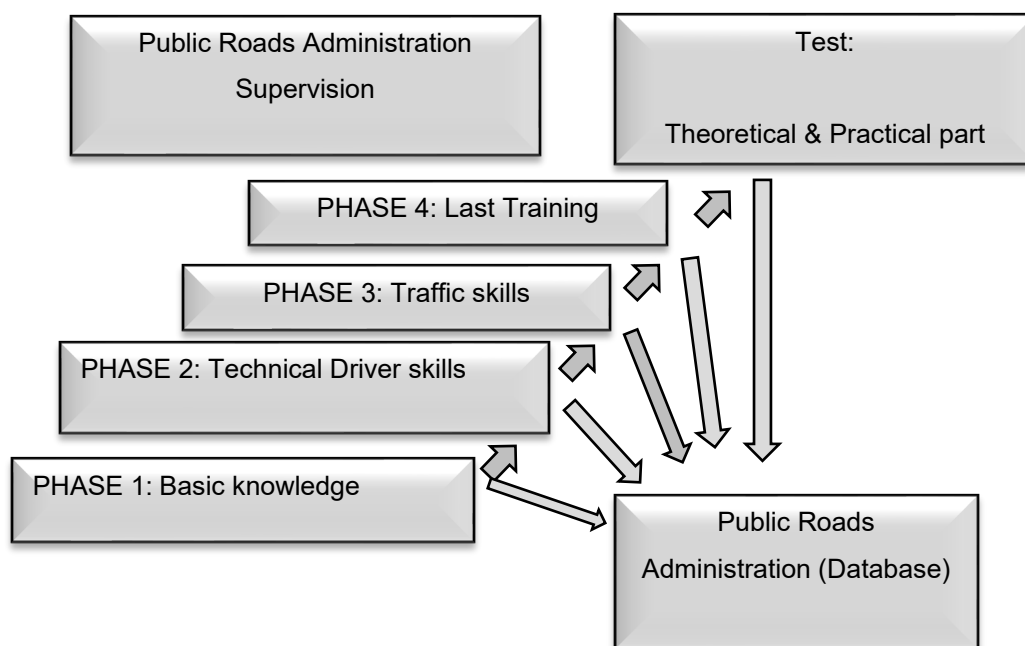
- Developing driver education and training programs and strategies.
- Defining educational objectives precisely (Lund, 2006, p. 16).
- Identifying educational needs, directing and managing the educational process.
- Adapting the education process, gaining the required competence.
- Risks perception, developing drivers' cognitive skills.
- Self-evaluation, Self-awareness.
- Analysis of the interaction between the components of the traffic system.

2.2.4 Effectiveness of GDE model as a guide in driver training and testing in Norway as a road safety measure to reduce crash involvement among young drivers

Norway, Finland and Sweden share an interest in how to implement GDE levels in driver education systems due to the common basis of these driving education systems in adopting the GDE model as a reference in driver education and training. Norway is one of the countries with the lowest rate of traffic accidents and injuries resulting from traffic accidents in the world. The number of accidents in 2006 reached (266 accidents, leaving 242 dead), so the number of victims decreased in 2015 to only 125 deaths, due to the fact that the Norwegian people are the most committed to traffic rules In the world, and also due to the professional efforts in the field of traffic safety on the part of the Norwegian government, which conducted several researches and studies on the GDE model (Touil and Salhi, 2023, p.530).

In 2010, these researches concluded with the design of the following model in figure 1:

Figure 1
Education driving system in Norway



Source: Adapted from Assailly (2010, p. 37)

Driver training is based on several sequential phases, where each phase must be completed and the required competence achieved before moving on to the next phase or level. The steering method that must be used varies according to the content of each stage to ensure the required level of competence:

- Phase 1. Basic knowledge: Everything related to legislation, behavioral tendencies, and about the importance of self-knowledge/Assessment
- Phase 2. Technical driving skills: This includes vehicle control skills in terms of (starting, stopping, adjusting speed...) to drive under normal circumstances efficiently and safely.
- Phase 3. Mastering traffic skills: Proper control of the vehicle in various difficult traffic situations and the decisions made by drivers to interact with each other and with other road users in the necessary and required manner.
- Phase 4. Complex traffic situations (Final training), self-knowledge, behaviour and judgement tendencies...
- Finally, a set of theoretical and practical tests are conducted, which confirm the driver's competence and ability to drive safely.

Thanks to this model, the Norwegian government was able to develop an advanced preventive plan that was launched in 2010, with the aim of reducing the number of deaths and serious injuries by half in 2020 (Touil and Salhi., 2023, p. 531). As the number of traffic accident victims should not exceed 775 dead and injured on Norwegian roads, at a rate of two people per day on average until vision zero in the distant future, within a set of basic themes:

- Designing safer roads, encouraging safer behaviors from road users, and promoting technology to produce safer vehicles.
- It gave great importance to the field of driver education and training, as Norwegians believe that young drivers are supposed to be good drivers once they obtain a license, otherwise why should they obtain a license if they are not good enough.
- Its preventive plan derived from studies, field research, and modern models such as the GDE model.
- It promoted positive behavior and reduced negative behavior, especially among the group age between (16-24) years.
- Monitoring the factors causing human damages in order to preserve human life in the first place.
- In preparing its plan, it relied on professionals, and assigned the task of traffic awareness to educational institutions.
- Urging drivers to apply written instructions regarding traffic prevention procedures and measures.
- It gave great importance to road engineering (road improvement, pedestrian paths, crossing points...)
- Its preventive plan included the human element, vehicles, environment, traffic laws and rules...
- In the field of preventive campaigns, it used special, professional means to disseminate traffic information.
- A comprehensive assessment (pre-, diagnostic, formative, and final assessment) was developed as part of the preventive plan.
- Adopting a points-based driving license system since January 2004 and implementing it strictly.
- Controlling the factors and causes of traffic accidents based on analyzing previous research data, such as autopsies of those killed in traffic accidents, to determine the cause of the accident and avoid it in the future.

- Adopting the evaluation as part of the plan, and the evaluation includes pre-evaluation, during, and post-evaluation.

2.2.5 Effectiveness of driving simulator learning in applying GDE-model content

The topic of simulation learning has received great attention from researchers due to the novelty of the topic and its importance in the field of driver education and training. Prévost (2014) revealed that the driving simulator is a good tool for teaching and evaluating drivers from a psychological and physiological perspective compared to the actual driving situation. In the same context, Jousse (2016) concluded that simulators play an important and effective role in acquiring knowledge and developing skills. These are the same results revealed by Berthelon and Perrin (2017), which emphasized the importance of using educational driving simulators in identifying failure mechanisms in the components of the traffic system (driver, vehicle, environment) and establishing a reference behavior that can be adopted to avoid accidents in the face of risks, thus enabling drivers to face dangerous situations without any real danger. The use of simulators is very important and effective in the field of driver education and training to pass driver's license exams and develop their safe driving skills. So far, countries that have employed this modern technology have achieved remarkable success in the field of traffic safety and security, as confirmed by the results of a Dutch study, where analysis of performance records revealed that drivers who passed an educational program on a driving simulator before training on the road in real life showed superior control over steering and speed as a result of their complete control of the vehicle and their awareness of road hazards (Ashleigh et al., 2013, p. 2).

The focus training on the lower levels of the matrix (vehicle control and mastery of traffic situations), has made drivers skilled in vehicle operation and able to pass a driving test, despite their lack of awareness of road hazards and other higher cognitive skills. This is evident in the overconfidence problem and dangerous behaviors among some drivers. Simulation learning allows the possibility of training in some of driving skills included in the various levels of the matrix: vehicle control skills, mastering traffic situations, acquiring automaticity, developing cognitive skills related to decision-making, and experimenting with risky driving scenarios without being exposed or exposing others to real danger. Also used regarding the "personal goals and skills for living level" of the matrix: reading maps while driving, after training, the participants adopted a safer driving by spending less time looking away from the road. The justifications for using driving simulators instead of a real car include:

- Safety: some exercises are too dangerous to try on the road (e.g. collision avoidance, alcohol effect on driving performance). These skills can be trained using driving simulators.
- Equipment cost: simulators allow the researcher to study the driver's responses to various changes in the car without having to build a car with these features or the same performance characteristics.
- Experimental control: a variety of test conditions can be described and applied consistently in the driving simulator. The weather conditions effect on driving can be controlled in the simulator, which constitutes one of the basic training for obtaining a driving license.

Accordingly, the Goals for Driver Education (GDE) model was developed to provide guidance on the types of skills that should be considered to increase the effectiveness of formal driver education. It has been shown that driving simulators can be effective for training high-level cognitive driving skills, suggesting that they can be used to enhance driver education and ensure mastery of these skills.

2.3. Proposal

The reality of traffic safety in Algeria and the level of safe driving behaviors among Algerian drivers warn of the danger of the exacerbation of traffic phenomenon for several reasons, most notably: the weakness of the driver education and training system, the lack of traffic culture and awareness, the absence of traffic safety behaviors among young drivers in particular, and the weakness of the mechanisms adopted in education and training process. Therefore, efforts must be intensified from now on to control this dangerous phenomenon that has become a threat to everyone without exception. This will not be achieved except by reviewing the current traffic system and subjecting it to careful study and analysis. In this context, the researcher believes that it is necessary to change concepts and reduce the focus on individual performance, while reviewing the content and strategies of driver education and training, and designing them according to a set of levels that are consistent with the nature of the physiological, psychological, emotional and cognitive growth of each level and so that they are compatible with the interactions of the social context from birth to adulthood, considering that safe driving is the result of the interaction of all these factors with each other in a complex and constantly changing environmental context.

Given the current traffic situation and the reality of driver education and training, and Algeria's current lack of an effective educational system in this field to reduce the increasing traffic phenomenon, it is necessary to present a proposal that generates accurate and reliable information, through an evaluation model built and relied upon through participatory processes and consultations with all stakeholders in the traffic system, including driving schools, driving instructors, politicians, professionals, local authorities, driver license inspectors, experts, and researchers in the field of traffic safety and security. Interaction between these sectors will achieve the desired educational goals, which require the presence of a qualified trainer to achieve the training program's objectives, using appropriate educational methods. The training process should also be evaluated and tested at the end of the training. Adopting and implementing these concepts in practice requires setting clear objectives, specific educational standards using a participatory approach, and a comprehensive evaluation system. Therefore, it is useful to design an educational program according to the hierarchy provided by the GDE model, starting from learning operational skills and ending with mastering advanced cognitive skills, according to an evolutionary perspective that allows keeping pace with modern trends, by choosing appropriate tools and adopting effective strategies to ensure the acquisition of the necessary competence and the adoption of safe driving behaviors

Based on what was mentioned, we proposed a training program based on driving skills included in the " GDE model " levels, as the hierarchy provided by the matrix includes all the safe driving skills needed by a safe driver, including high-level cognitive skills (risk perception, awareness of road hazards, and self-assessment).

The five-level matrix forms the basic reference for program content design, which serves as an organizational tool that defines the educational objectives required to train drivers effectively and safely. It aims to guide the training process by defining the knowledge, skills, and behaviors that trainees must acquire. The general objectives include general training goals, such as developing safe and responsible drivers. Specific objectives branch out from these goals, encompassing specific skills to be learned, such as vehicle control, understanding traffic laws, and defensive driving. To implement this program, it is proposed to use a driving simulator as the only tool capable of providing the required training environment, which is impossible to provide and experience in real life for safety reasons (due to its dangerousness.). Finally, the dimensions of vehicle control and manoeuvring, mastery of traffic situations, and self-awareness of road hazards are proposed as key axes in building a comprehensive and effective training program.

Compared to the national driving training program, which is mainly based on training some basic vehicle control maneuvers, we can say that the driving task is more than just "steering and controlling the car", and that the real goal of driver education and training is to create drivers who have the necessary skills and sufficient awareness to ensure the safety of all road users. This can only be achieved through the hierarchy provided by the GDE model, as it provides a comprehensive view of the driving task and the content of driver education.

To ensure the effectiveness of applying the content of the training program designed by the researcher according to the GDE model hierarchy, it was suggested to use a driving simulator to teach and train skills that are impossible to apply in reality for security reasons. This training program aims to develop safe driving skills included in the GDE model using a driving simulator through the following:

- Developing vehicle control skills efficiently, effectively and safely:
 - Mastering basic maneuvers.
 - Controlling the vehicle.
- Developing skills to deal with various traffic situations effectively and safely:
 - Mastering safe driving skills across various roads and traffic conditions
 - Entering, overtaking, and exiting traffic
 - Night driving.
 - Driving in bad weather conditions.
- Developing self-awareness of road hazards, through:
 - Realizing the risks posed by car as a machine.
 - Developing probabilities and expectations for various traffic hazards.
 - Awareness of road hazards.

At the end of the training program, the driver becomes able to control the vehicle and deal with various traffic situations efficiently, effectively and safely, while adopting safe driving behaviors that ensure his safety and the safety of other road users.

3. Conclusion

In parallel with recent developments and the emergence of modern technology as an option that complements the role of traditional learning without taking into account the risks and spatial and temporal constraints imposed by the real reality, it is necessary to draw attention to the need to integrate modern technology as called for by the GDE model, as one of the possible

solutions to address the traffic problem in Algeria. The importance of the GDE model is evident in teaching procedural driving skills, developing high-level driving skills, and developing self-awareness skills of road hazards, which makes it possible to detect and anticipate hazards, especially since the current practical training to obtain a driving license is limited to teaching basic skills, while the issue of recognizing and dealing with hazards is not addressed, and if it is addressed, it is limited to the theoretical aspect without actual practice for security reasons.

The GDE model refers to the existence of different methods of driver education and training, the most important of which are supervised driving experience and driving simulation. Simulation learning is one of the latest methods used in the field of driver education and training, to bring the learner closer to the real reality that is difficult to provide due to its danger or high cost. This type of training depends on driving simulators with their systems and equipment, and this type of training is widely conducted in Australia, Europe and the United States of America. The Netherlands is currently a world leader in the use of simulators to teach procedural skills and develop high-level cognitive skills.

The proposed training program, designed according to the skills included in the GDE model levels, and its organizational and practical specifications, contributes significantly to developing safe driving skills among drivers (vehicle control skills, awareness of the risks of poor vehicle control, deal with difficult traffic situations, and awareness of road hazards). It is recommended to adopt simulation learning to improve safe driving skills, risk awareness and understanding traffic rules among drivers, with a call for the necessity of using simulators in driving schools to help candidates and prepare them to deal with various potential traffic situations. It is hoped that by providing driver education and training according to the GDE model, which contains the hierarchy of all safe driving skills that a driver needs, including high-level cognitive skills (hazard perception, road hazard awareness, and self-evaluation), young people would become more skilled and safer drivers, thus reducing their risk of accidents. To include the content of the GDE model within current and future education strategies, it is necessary to combine the efforts of all parties concerned with traffic safety and security by:

- Reviewing the content of driver education and training programs and their implementation mechanisms, with the need to provide the material and human capabilities and training needs of drivers and provide them with sufficient knowledge and skills that qualify them to be safe drivers, in addition to creating an incentive to apply these skills while driving on the road.
- Adopting the proposed educational program within the pedagogical strategy adopted in

educating and training drivers who are candidates for a driver's license, or as a complementary program within the requirements for obtaining a driver's license.

- Reviewing the strategies and tools adopted in implementing the content of driver education and training programs, with the need to employ modern technologies and adopt educational security models and strategies that have proven their effectiveness in many leading countries.
- Employing modern technology in teaching and training drivers in driving schools and driver training and rehabilitation centers.
- Understanding the basic mechanisms of driver education and training using simulators compared to practical driving in real life and employing them in driving schools and driver training centers.

4. References

Ashleigh, Filtness., Bates, Lyndel., Fleiter, Judy., Watson, Barry., Tones, Megan., and Williamson, Amy. (2013). How would changing driver training in the Queensland licensing system affect road safety. Queensland: The Centre for Accident Research and Road Safety.

Assailly, Jean. Pascal (2010). Recherches et pratiques éducatives innovantes (matrice GDE) pour l'accès au permis de conduire en Europe (4). France: Institut national de sécurité routière et de recherches. bit.ly/3lXm26d

Assailly, Jean. Pascal. (2009). La matrice Gde ou l'œuf. France: l'Institut national de recherches sur les transports et leur sécurité.

Bates, Lyndel., Filtness, Ashleigh., Fleiter, Judy., Watson, Barry., Tones, Megan., and Williamson, Amy. (2013). *How would changing driver training in the Queensland licensing system affect road safety? Deliverable 1: Trends in driver education and training (1)*. The Centre for Accident Research and Road Safety. https://swov.nl/nl/publicatie/how-would-changing-driver-training-queensland-licensing-system-affect-road-safety?utm_source=chatgpt.com

Berthelon, Catherine., and Perrin, Christophe. (2017). Introduction de scénarios d'accident dans les simulateurs de conduite : intérêt pour l'analyse du comportement des conducteurs. *Carnets d'accidentologie*, 13-21. <https://hal.archives-ouvertes.fr/hal-01575732>

Boccaro, Vincent., Vidal Gomel, Christine., Rogalski, Janine., and Delhomme, Patricia. (2014). Concevoir des référentiels comme des outils pour les formateurs ? Réflexions à partir de la formation initiale à la conduite automobile. In Prot Bernard (Eds.), *Les référentiels contre l'activité, en formation, gestion, certification* (119-132). <http://bit.ly/47j43iD>

Boudrifa, Hammou. (1991). A study on the causes of traffic accidents in Algeria. Algeria : University of Algeria.

- Corneloup, Valentin. (2019). *Apprentissage et évaluation des compétences de conduite de haut niveau en réalité virtuelle: utilisation des simulateurs de conduite pour mesurer et développer les compétences perceptives et cognitives des conducteurs novices* (Thèse doctorat, Université Paris Descartes, France). https://theses.hal.science/tel-03131361v1/file/va_Corneloup_Valentin.pdf
- Fleiter, Judy., Ashleigh, Filtness., Bates, Lyndel., Watson Barry., and Williamson, Amy. (2013). How would changing driver training in the Queensland licensing system affect road safety? Deliverable 3: Evidence-based driver education policy options (2). Queensland: The Centre for Accident Research and Road Safety.
- Gregersen, Nils Petter. (2004). The content of driving instructor training with regard to driving behaviour and road safety, based on the GDE matrix EU MERIT . Linköping: Swedish National Road and Transport Research Institute (VTI). https://www.cieca.eu/sites/default/files/documents/projects_and_studies/2MERITWorkingPaperWS1En-1.pdf
- Jousse, Elisabeth. (2016). *Apprentissage sur simulateur de conduite automobile*, (Thèse doctorat, l'université Angers, France). <https://dune.univ-angers.fr/documents/dune5385>
- Lund, Bjorn. (2006, March). *New Rider Training System in Norway*. The International Motorcycle Safety Conference. California, USA. <https://msf-usa.org/wp-content/uploads/2023/03/new-rider-training-system-in-norway.pdf>
- National Center for Road Prevention and Security. (2018). Annual report 2017: Traffic accidents registration in Algeria, CNPSR.
- National Delegation for Road Safety. (2022). *Road Safety Problems and Solutions*. DNSR.
- Nieminen, Ari Pekka., and Susimetsä, Marko. (2018). From driving skills to driver behaviour. In Marko Susimetsä, and Heli Ainjarv (Eds.), *Theory and Practice in Driver Education*. Tallinn University Press, Tallinn, Estonia. <https://research.fi/en/results/publication/0333536818>
- Peräaho, Martti., Keskinen, Esko., and Hatakka, Mika. (2003). *Driver competence in a hierarchical perspective; implications for driver education* (Report to Swedish Road Administration). University of Turku. https://media.freeola.com/other/23050/howtoteachthegde-matrix_1.pdf
- Prévost, Céline. (2014). *Apport de la simulation dans l'évaluation des aptitudes à la conduite : l'exemple des personnes cérébrolésées* (Thèse doctorat, Université Rennes-2, France). <https://tel.archives-ouvertes.fr/tel-00962172>
- Rahali, Halima. (2015). *The effect of teaching using virtual classrooms on developing mastery motivation and some learning outcomes* (Doctoral Thesis, Batna 1 University, Algeria).
- Rodwell, David., Watson, Brown., and Bates, Lyndel. (2023). Perceptions of novice driver education needs; Development of a scale based on the Goals for driver education using young driver and parent samples. *Accident; Analysis and Prevention*, 191(1), 107-190. <https://doi.org/10.1016/j.aap.2023.107190>

- Santos, Jorge. Almeida., Da Silva, Fátima. Pereira., and Meireles, Andreia. (2014). Road Accident: Driver Behaviour, Learning and Driving Task. *Procedia-Social and Behavioral Sciences*, 162, 300-309. <https://doi.org/10.1016/j.sbspro.2014.12.211>
- Sarolta Kiss, Diána. (2016). What kind of steps shall we implement from the GDE matrix into driver education of Hungary to decrease risk of accident among novice drivers. *Transportation Research Procedia*, 14, 3821-3828. <https://doi.org/10.1016/j.trpro.2016.05.467>
- Schulte, Kay. (2014, June). *Framework for a curriculum (or blueprint) for driver education*. Paper present at the International Commission for Driver Testing. Berlin, Germany. https://www.asociaceautoskol.cz/storage/uploads/WG2_Proposal-Framework-WG2-June2014.pdf1644586292.pdf
- Touil, Adel. (2023). *The effect of simulation learning on developing safe driving skills. An Experimental study on a sample of drivers using a "driving simulator" according to the GDE model*, (Doctoral Thesis, Batna 1 University, Algeria). <https://dspace.univ-batna.dz/items/12b57bff-3623-431a-978f-4a0584f9ad14>
- Touil, Adel., and Salhi, Hanifa. (2023). Safe driving behavior level for young drivers And its relationship to some demographic variables Field study under the Goals of Driver Education Matrix GDE. *Journal of Psychological and Educational Studies*, 16(1), 510-525. <https://www.asjp.cerist.dz/en/article/216272>
- Tronsmoen, Torbjørn. (2011). *Lay and professional practical driver training in Norway: A comparison of subject matter content and traffic safety outcomes* (Doctoral Thesis, Norwegian University of Science and Technology, Norway). <https://www.researchgate.net/publication/312044512>

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