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Workshop about the use of simulators in driver training

MOVING organized, the workshop about "The use of simulators in driver training" in collaboration with CIECA, the International Organization for Driver Testing.
The workshop took place on the 24th of November 2022 in the headquarters of Springer Fachmedien in Munich.

With this event, MOVING and CIECA have contributed to the discussion on the use of simulators in driver training fostered by DG MOVE of the European Commission. Latest developments in simulators were presented, and all the participants had the opportunity to take part in a practical session with Category B simulators during the event.

Luisa López Leza on behalf of Mr. Satz, President of MOVING, and Philippe Usson, representative Driving Licence, Ministry of Interior (France) , acting CIECA Secretary General, Treasure and Member of the CIECA Expert Advisory Group welcomed the participants. The Chair of the workshop was Mr. Schulte, General Coordinator of the Department "Prevention of work related road accidents" in the German Road Safety Council and Member of the CIECA Education Topical group.
They were three Group Discussions, all of them guided by an ETG Member to sharing experiences on the use of such technologies and other uses that respond to impending needs. Some of the conclusions of these Group discussions were:

1. Simulators need to be used as a complement of the theory and practical training.
2. It is necessary to create a C. V or guidelines for the use of simulators and the normal integration in education for driving.
3. There are many areas of application for simulators in the context of driver education and driver training.
4. Simulators are a very appropriate tool for:
    - The emergency driving;
    - Accompanied driving;
    - Dangerous situations;
    - Driving under bad weather conditions: snow; raining etc. ;
    - Hazard perception;
    - People with disabilities;
    - Special country driving situations.

5. It must be defined the contents, goals and the didactics which can be learnt by the use of simulators within the framework of training.

The Practical Session on car simulators scheduled in the Workshop offered the opportunity to all the participants to practice the learning targets achievable on a simulator and their impact in order to enrich the theoretical and practical knowledge on driving education.

Mr. Fretay, General Manager of Codes Rousseau in France, gave the first presentation of the workshop about *"How education with driving simulator can accompany the revolution in car technology"*.

According with Mr. Fretay's speech, the car is becoming a luxury item in France. Since 2001, car prices (new & used market) have grown twice as fast as inflation and at least four times as fast as median household income.

The reason of this situation is due to increasing safety standards; switch to EV's; the shortage of semiconductors; rising raw material costs and prices.
The main consequences of these factors in the French market are: drop of new car sales; demand transferred to used car: price increase +26% 2022 vs 2019; the average age of cars on road hits new high: 11 years in France in 2021.
In the context of these circumstances, Mr. Fretay highlighted the position of French driving schools' networks. In fact, in September 2021, the ECF driving school group has announced "its intention to "green" its fleet of vehicles in the next four to five years**.** This transition will take place in two stages:

- Elimination of all diesel vehicles in 2022;
- Transition to a 100% electric fleet by 2026".

In addition to these concerns, it will be a quick shift of driving school car fleets to automatic gearbox ; car manufacturers will *stop providing manual gearbox* in the next 4 years. Driving schools *cars* are *rent and renewed every 24 months* or less.
Mr, Freaty presented also the situation of young drivers. He explained that cars with manual gearboxes will remain present, especially on the second-hand which is still essentially 'manual' and accessible to 'young drivers'; used car prices are rising sharply due to price increase and volume decrease of brand-new cars; Affordable cars are older and older; Manual driving licence isn't a choice for young drivers: In 2022 5% of driving licences delivered in France were B78 automatic driving license.
In October 2016 French regulation was adapted to facilitate the transition from automatic to manual transmission. According with the regulation: To convert a B78 license to a traditional B license, the driver must**:**

- Wait 3 months after obtaining their automatic transmission license;
- Pass a 7-hour training course proving their ability to handle a mechanical transmission.

In July 2019 regulation has introduced the possibility to use driving simulator exercises during 1 out of the 7 hours. The next step could be:

- Eliminating the 3-month delay required for this conversion;
- Authorize the use of the simulator for all 7 hours.

Mr. Fretay **presented the benefits of the use of simulators** from automatic car driving license to license B trough several perspectives:

1. From the point of view of optimization of the lessons via the simulator, the use of simulator for the 7 hours of training:
    - Will promote the progressive acquisition of the right gestures and to allow to become quickly autonomous;
    - Is perfectly adapted and largely sufficient for:
        - manipulate the gearbox;
        - use a clutch;
        - coordinate the whole to manage driving situations such as changing direction, crossing traffic circles, intersections and maneuvers;
        - Candidates who are already familiar with the driving environment (driving experience with their automatic transmission license).

2. From the point of view of an optimized and less stressful training**:**
    - Driver will have already passed his B78 license : he already knows how to apprehend his environment and can therefore concentrate on learning the mechanical tasks.

- The simulator thus reduces the stress linked to mechanical tasks, reduces the apprehension of the real world and allows the student to be less stressed when the time comes for him to get into a vehicle with a manual gearbox.
- Simulator also allows the student to replay the scenarios for which he or she is not yet comfortable in order to perfect his or her driving skills.
- This technology allows the student to progressively acquire the right gestures and to quickly become autonomous.
- The simulator is safer: It allows you to learn how to drive without any real danger for the driver or for the road users.

3. From the point of view of economic benefits of the simulator use: a more affordable price for driving education**:**
    - Driving schools will not be obliged to keep a manual transmission vehicle.
    - Costs of operating a simulator are far less expensive than those for a car: rent, maintenance, insurance, energy, taxes, repair at the end of leasing.
    - Most driving schools are one-man businesses and have only one vehicle, so they cannot afford to have a vehicle with an automatic gearbox and a vehicle with a manual gearbox that would only be used for the 7-hour training.
    - The simulator does not require an instructor to be present during the entire training hour.
    - Biggest driving schools can implement simulation rooms.
    - Educational simulation programs ensure the mastery of practices and behaviors for the best road safety.
    - A less expensive training for the driving school is a less expensive training for the student:
        - B license costs 1800 € on average 32 hours required (on average) for 20 mandatory hours;
        - If the 7 hours are done on a simulator, a B license would cost 20% less with a saving (on average) of 8h: from 32h to 24h.
    - A better success rate at the exam: actual success rate is 58% at first examination. It could reach 75% similar to accompanied driving trainees.
    - Less time to take the exam because less failed applicants.
    - Gain in the purchase of the first car.

4. From the point of view of societal benefit of the simulator use: keep the driver's license accessible everywhere in France.
   Today, density of territorial network of driving schools *(12 000 driving schools is France)* gives everyone an access to driving lessons not far from home. Small driving schools may be the least able to survive the driving revolution: there is a great risk of rural learning deserts. The simulator would therefore help to maintain rural driving schools and thus the territorial network necessary for everyone to have access to a driving license.
   It would allow a proximity access for an economical training to the driving license on the whole territory.

5. From the point of view of ecological benefits of the simulator use: training adapted to current environmental issues:
    - Avoids the purchase, for the trainer, of a manual transmission car for this training only.
    - Allows a wider use of hybrid or electric vehicles by driving schools.
    - A driving simulator does not emit CO^2, NOX, airborne particulate emissions.

   With the simulator use, all 7-hour training courses would be more ecological, avoiding the emission of 4 kg* of CO2 per hour of driving. If the 880,000 learner drivers with a driving

license had recourse to simulators for the 7-hour training, each year nearly 25,000 tons of CO2 would not be emitted.

Concerning the progress of Advanced Driver Assistance Systems (ADAS) in France, Mr. Fretay highlighted the rapid development of the ADAS. Advanced safety devices mandatory on all new vehicle models sold from July 6, 2022:

- Intelligent Speed Adaptation System;
- Facilitation of the installation of an alcohol ignition interlock device;
- Driver drowsiness and attention warning systems;
- Advanced driver distraction warning systems;
- Emergency stop signals;
- Reverse detection systems;
- Event data loggers;
- Accurate tire pressure monitoring system.

In France there is a limited knowledge of driver assistance systems. For thar reason, it is important to know how a simulator can educate young and experimented drivers on ADAS:

- Training the most advanced ADAS it requires the use of vehicles with automatic transmission.
- It would therefore be encouraged by the implementation of driving simulators that would allow:
    - A very fast conversion of the driving school fleet to automatic transmission.
    - Educational programs simulating the surprising reactions that ADAS can bring for a driver who has not been trained:
        a. Line assist with an absence of turn signal;
        b. Adaptive cruise control which re-accelerates on roundabouts.

- A specific training in autonomous driving could be sanctioned by a complementary training certificate as soon as the training has been carried out on a level 3 vehicle or on a simulator with a specific program.
- Educational programs on simulator could help:
    - Driving instructors for ADAS not available in their cars.
    - Learners with driving situations never met in practical lessons.
    - In understanding limits of ADAS.

Conclusions of Mr. Fretay presentation

The 7 hours training for manual gearbox with a simulator benefits:

1. More affordable and easier driving license with high quality training.
2. Solution to compensate for the lack of human resources (instructors, examiners).
3. Help driving schools to accelerate their own transformation towards EV's or Hybrid cars.
4. More environmentally friendly than a training in car.
5. Could help to maintain rural driving schools.

The ADAS teaching with a simulator:

1. Makes easier to simulate each ADAS systems in every condition.
2. Can make possible to test and certify the knowledge acquisition by learners.

Birgitta Thorslund, LiU Linkopings Universitet and Helena Selander, VTI gave the second presentation about: *¨Driving simulators for driver education and driver testing in Sweden"*.

According with the data presented in Sweden the number of approved driving tests are decreasing. The situation today is: driving tests are decreasing. Difficult testing certain complex and risky elements. The traffic environments are different depending on the time of year, time of day and where in Sweden the driving test is performed; The test cannot always include all the elements that are needed for a safe and skilled driver.
In this context it is necessary to ask: Do the training and the tests capture traffic-hazardous behavior? How do we train or test situations that are inappropriate or dangerous? Simulators as a tool?

The reality is that simulators have been established as important tools in professional driver education and are now becoming more common in traffic schools.
The University of Linkoping and the Road and Transport Research Institute are preparing a Survey which examines possible use of simulators in driver testing and evaluates benefits of present use in driver education. The research questions are:

- Can simulator screening be used to test situations difficult to assess in the driving test?
- Can risk awareness and self-awareness be tested with simulator driving?
- Which benefits do traffic schools see with simulator use in driver education?

The aim of the research is to examine possible use of simulators in driver testing and evaluate benefits of present use in driver education.
Interviews with driving instructors, 14 driving instructors have been done to assess their experience with driving simulators.
The results were positive to use simulators as a complement:

- To practice maneuvering;
- Train risky traffic situations that are difficult to experience in real traffic.

Uncertainties about:

- How to use simulators to achieve the objectives of the syllabus;
- Organization and structure of driving education;
- Economy (investments and costs).

They designed sample situations. In fact, driving school students were invited to join the study. Performed the screening test at the driving school a few days prior to the driving test. 70 participants in total, 46 females. They are going to publish the Survey soon and to think about further steps towards implementation of simulators in driver testing in Sweden, such as: unite and improve usage of simulators in driver education; complete driver testing with situations that are difficult to bring about at driver testing; ensure that drivers with clear deficiencies in risk awareness are detected before the real driving test.

Prof. Dr. Stefan Reindl and Alexander Wottge M. A. from the Institute for Automotive Research (IfA) gave the third presentation about "*Simulators in Driving Schools: Driver Training for Shifting Manual Transmissions*".

They presented the first results of the Survey about Driver Training for Shifting Manual Transmissions. Prof. Dr. Stefan Reindl highlighted that with the Green Deal, the European Commission set itself a clear goal of creating a transition to a sustainable economy, with the transport sector being one of the main pillars. The focus on electromobility is one of the main pillars of the traffic and mobility transition:

1. From the economical perspective: there has been an increase in consumer prices in the German economy. Rising raw material prices and the CO2 tax are also affecting fuel prices. The costs in driving schools are also increasing drastically.
2. From a social point of view: digitization is well advanced in all parts of society. Especially young generations demand highly flexible access to services. They see digitized processes as a standard.
3. Technically: in the passenger car sector the market for electric vehicles is growing strongly. Due to their technical concepts those cars are only available with automatic transmission. In addition, autonomous driving functions are often only available for automatic vehicles.
4. Ecologically: Environmental and sustainability aspects are playing an increasing role in broad sections of the population. In addition to public institutions, companies from the private sector are also positioning themselves more strongly as sustainable enterprises.
5. Legally: the new automatic transmission regulation makes possible to take a driving test on a vehicle with an automatic transmission while at the same time obtaining a driver's license that qualifies the driver to drive vehicles with manual transmissions (B197).

Prof. Dr. Stefan Reindl explained the design of the Driving School Survey Research conducted by MOVING. It has been based on a questionnaire- online questionnaire- with a total of 25 individual questions. There has been a 115 return of questionnaires from 350 contacted driving schools, only driving schools with driving simulators (1.6 driving simulators per driving school). The survey period has been from 1st to 2 nd quarter 2021:

1. The structural data on the surveyed driving schools were: Big cities: 26%. Medium Sized cities: 35%. Small Towns: 32%. Rural Areas: 6%.
2. To the question: How many simulators are used in your driving school? 76% replied 1 simulator.
3. To the question: Which share of your driving learners use the driving simulator? 57% replied over 90%. The result about training content learned with driving simulators showed:
    - Vehicle operation: 100%;
    - Shifting competence: 96%;
    - Driving the vehicle in traffic: 95%;
    - Driving tasks: 73%1;
    - Preparation for unusual hazardous situations: 54%;
    - No specification: 2%.

4. To the question: How do you integrate the possible simulator hours into driver training? The answers were:
    - As a mandatory module of a defined training package: 67%;
    - As an individually booked additional package supplementary to the driver training: 23%1;
    - As an individually booked supplement to driver’s training: 10%;
    - Only by request: 0%.

5. To the question: Has the purchase of a driving simulator paid off economically for your driving school? The results have been:
    - Yes: 90%;
    - No: 10%.

6. To the question: Can a driving learner also use the driving simulator to learn the shifting competence necessary to drive a manual car? The results have been:
    - Partially, the simulator can support in conjunction with the driving school car: 52%;
    - Yes, shifting competence can also be learned in the simulator.: 48%;
    - No, shifting competence can only be learned in a driving school car.: 0%.

7. To the question: How many simulator hours would you estimate for an average driving learner?: The majority 64% estimated between 6-10 hours.
8. To the question: How would you rate the driving simulator in terms of teaching shifting skills? … ** *German school grading system: 1=very good to 6=insufficient.*
    - Good: Pedal Control; gearshift control; shift down; fluid shifting operations; timely and appropriate acceleration; Suitable gear for acceleration;
    - Very good: Shift up; startup; grinding point; correct choice of the gear; smooth and fluid staring movements; acceleration.

This is the first part of the survey; new Planned Steps have been approved to carry on a new Survey with a Practical Analysis which the central goal is: What is the most successful way to learn driving with manual transmission? By car and simulator or only by car.
The evaluation will be focus on vehicle operations (Operating Pedals; Starting; Operating Gearshift; Upshifting/Downshifting; Breaking; Gear Selection) and Driving Situations (Changing Lanes; Driving Curves; Overtaking; Traffic Junctions; Roundabouts; Pedestrian/Railway Crossings). 20 Driving Schools in different areas and cities in Germany will participate in the new Survey with 3 Structure Types: Rural area & Small Towns Medium-Sized Cities Big Cities. 120 Driving Learners (60 Experimental Group 60 Reference Group). The estimated period of duration is of 2 months during the first quarter in 2023.

Mr. Schulte, General Coordinator of the Department "Prevention of work related road accidents" in the German Road Safety Council gave the fourth presentation about the "*Use of simulators - new opportunities for the education and training of very difficult psychological situations in road traffic"*.

Mr. Schulte highlighted that Driving is a physical, mental, social and emotional activity. He showed different driving situations where the simulators can contribute to improve normal driving by car.

Simulators brings new opportunities in driver education:
1. Increasing competence in hazard perception;
2. Increasing competence in self-reflection;
3. Addressing emotions while driving;
4. One-to-one supervision by driving teacher;
5. Open questions to make emotions and thoughts visible.