

Introduction

In general e-learning regarded as a tool for driver training denotes all kinds of techniques using electronic means or multimedia techniques to enhance traffic safety through improvement of drivers skills and knowledge.

As such e-learning techniques can employ strategies, which ranges from theoretical knowledge of traffic rules and regulation to training of certain skills or techniques or improvements in awareness of special subjects.¹

Though this essentially covers all kinds of applications it also makes it more prudent to make clear the different areas of driver training where e-learning are applied presently.

This paper will primarily address these questions through questionnaires distributed to participants within the NoE HUMANIST. In addition results from former European projects which have dealt with driver training will be used as a platform for analysis, in particular TRANIER² and GADGET³. Based on work in these projects considerations of the areas and content, where e-learning are applied, will be addressed in the following sections. It should be emphasised that this paper primarily will address aspects of driver training, which are currently available. To a lesser extent future applications of e-learning and suggestions as how to implement them will only be discussed briefly.

E-learning as phenomenon

E-learning is becoming a more and more widespread tool for training and education within many spheres of society. It has been stated that the future of e-learning is not whether it should be deployed or not but rather how, when and to what end (Littig, 2003 from Littig et al, 2003). The European Commission have commissioned several projects on e-learning within the Leonardo da Vinci project (Littig et al, 10, 2003).

E-learning basically moves the learning process from the classroom or traditional written curricula into the learners world, providing access to learning anytime or anywhere without geographical or time barriers. In addition it is technically possible, e.g. through the internet, to provide immediate access to learning materials and interaction with experts or and fellow learners. Finally the advancement of computers capacities makes it possible to illustrate real life driving situations and animated scenarios thus making the experience quite realistic. This gives e-learning the potential to become a useful tool to develop the learning processes, but essentially it has to be borne in mind that the learning outcome will to a large degree depend on the pedagogical design of the whole learning process.

Though no projects specifically have dealt with e-learning as a tool for driver training several European projects have explored the feasibility of multimedia tools or other interactive devices for driver training and the context to put driver training within. The European projects GADGET addressed issues relevant for driver training and in particular training of novice drivers. Similarly the European project TRAINER addressed some of

¹ Though E-learning potentially covers all areas of the driving task it should be emphasised that the use of driving simulator will not be covered within this paper. This area is covered more extensively in other papers of this workshop.

² System for driver Training and Assessment using Interactive Evaluation tools and Reliable methodologies WP2.1

³ Guarding Automobile drivers through guidance education and technology.

these issues but specifically put them within a context of multimedia or simulator use relevant for driver training.

General objectives of driver training

When discussing issues of driver training it is beneficial to analytically distinguish between the target groups e.g. training of novice drivers from in-service training of professional drivers or experienced drivers. Though an overlap occurs between the different groups as they have to abide the same rules and regulations training typically rests on different approaches to the driver. The novice driver needs to acquire both theoretical and practical skills and knowledge whereas training of experienced or professional drivers typically is directed at more specific areas of the driving task.

Similarly it is generally accepted that driver training both needs to encompass a theoretical and practical component, which ideally should enable the student to both acquire abilities to master the driver task by means of a more abstract approach and through practical training by driving in a real vehicle in real traffic.

When discussing use of multimedia tools in driver training e-learning applications typically is found within the first category covering the theoretical part, providing the premises for learning to drive in real traffic.

Novice drivers

The existing driver training courses are based on theoretical assumptions about driver behaviour and the driving task at hand. A premise is that driver behaviour is organised in four different hierarchical levels. The European project GADGET identified four levels, which compromised the driving task; vehicle manoeuvring, mastery of traffic situations, driving goals and context and goals for life. Ideally the driving curriculum should cover all areas and address behaviour of knowledge and skills, risk increasing factors and self-evaluation. In practice however it was concluded that traditional driver training typically only covered the first two levels whereas the other two levels typically is not included or simply omitted from the driver training (Hattaka et al, 1999).

Experienced, professional drivers and drivers with disabilities

These groups of drivers typically have several years of experience. However the application or motivation of driver training for these driver groups typically differ quite substantially. Experienced driver undergoing post-license training typically have had a conviction of serious traffic offence (e.g. driving under influence of alcohol) or the offence might have led to a temporary loss of driver license. Professional drivers typically undergo training in handling difficult driving manoeuvres, driving special vehicles or goods. Disabled drivers are typically trained for the purposes of identifying functional weaknesses thus not for the purposes of training per se but rather to identify which conditions of driving they would encounter difficulties with.

Areas currently covered driver training

Driver training covers both training of novice drivers and in-service training of professional drivers or experienced drivers. Though an overlap occurs it might be beneficial to distinguish between the two as they typically rest on different approaches to the driver. Typically the novice driver needs to acquire both theoretical and practical skills and

knowledge whereas training of the experienced driver typically are directed at more specific areas of training.

Novice drivers

The existing driver training courses are based on theoretical assumptions about driver behaviour and the driving task at hand. A premise in the European project GADGET was that that driver behaviour is organised in four different hierarchical levels. The idea of the hierarchical approach is that abilities and conditions on a higher levels influence demand on lower levels (Hattaka, 1999). The four identified levels are (the highest levels rank first):

- Goals for life (personal motives and beliefs): this level is based the assumption that lifestyle, social background, gender, age, income etc., has an influence on driving behaviour and attitudes towards driving

- Goals and context of driving: This level focuses on the context in which driving is performed particularly on choice of choice and planning of trip, travel-mode, time of day, road situations or driving under influence of driving deteriorating conditions or substances.

- Mastering of traffic situations: The conditions applied to level refers to the mastering of adaptation to specific (though continual changing) traffic situations, such as overtaking, speed choice, perception of hazards.

- Vehicle manoeuvring. The lowest level refers to vehicle control such as shifting gears or steering manoeuvres. On this level is also included evasive manoeuvres, control in different weather conditions and use of passive safety measures such as seatbelts and airbags.

In addition to the four levels the GADGET-matrix proposes that the driver training curriculum should address safety relevant issues at the different levels according to three different levels of risk-awareness:

- Knowledge and skills: this level refers to the skills a driver needs for driving under different circumstances.

- Risk-increasing factors: this level deals with aspects of driving or traffic that can increase the risk, such as worn out tyres, perception of the traffic situation, speed adjustment, risk acceptance.

- Self-evaluation: this level emphasises how the driver is capable to assess the performance on the four levels. It really points to a critical self-adjustments of all from skills in vehicle handling to reflection of individual risk attitudes.

Figure1: GADGET-MATRIX

Ideally the driving curriculum should cover all areas of the matrix and address the appropriate driving behaviour associated. However it is stated that traditional driver training typically only addresses the first two levels, vehicle manoeuvring and mastery of traffic situations, whereas the other two typically was not included or simply omitted from the driver training (Hattaka et al, 1999).

With the advent of new multimedia tools and advanced computer graphics it has been proposed that the existing curriculum and the additional levels of driver training would have good chances of being incorporated in the new technologies.

The Gadget project did not cover professional drivers, experienced drivers or disabled drivers. However as most of the hierarchical levels of the Gadget matrix, especially level three and four should be included as part of the general mastering of the driver task it would be reasonable to propose that these skills also applies for these groups.

Results

As mentioned earlier e-learning application can take several forms according to the media used, the target group and driving skills in question. For purposes of this analysis the applications will be categorised according to the above-mentioned categories and available information.

As the participating institutions reported relatively few applications a survey conducted within the TRAINER project comprising multimedia tools as driver training tools will also be included.

The results presented in this paper are based on an internal survey conducted through structured questionnaires sent to the participating institutions participating in the EU-funded NoE HUMANIST. The questionnaires covered areas such as target group; content of curriculum; media used; level of interactivity as well as elements for improvement as well as action taken towards validation of the learning potential of the applications.

As can be seen from table 1 only seven institutions had been involved in either development or use of e-learning applications. As this hardly covers the areas of e-learning included are also applications from the project TRAINER as a reference.

Content

Most of the applications were developed and used as supplement to existing training courses. For the majority of applications the purpose was to give the driver additional possibilities of learning existing curriculum and were based on existing training programmes.

Five of the applications (1, 2, 3, 5, 6) programmes based on existing curriculum. The Austrian, two of the Czech the, the German and the Dutch applications were developed for training of novice drivers though the Dutch were developed for novice army drivers.

The applications applied existing theoretical training though a multimedia platform. The applications explains rules, signs and regulations based on the existing training curriculum. However all rules, traffic situations were

The Austrian (1) and German (5) applications were developed as supplement to the compulsory theoretical driving school training. In both Austria and Germany the student has to follow theoretical training at driving schools, whereas the Netherlands allows student to study theory at home. However the Dutch application were only used in training of military drivers. It is unknown what the situation is in the Czech Republic (Groot et al., 2001).

Almost all applications (1, 3, 4, 5, 6) focused on skill learning (understood as knowledge of traffic rules, regulations, understanding of signs etc.).

Similarly some of applications (1, 5, 6, 7) also employed training in of defensive driving techniques (e.g. illustrations of approaching intersections or elements of hazardous driving).

The Dutch application were the only on addressing attitudinal elements.

Applications 1, 3, 4 stated that the application employed a testing element, which the student could encounter at the theoretical driving test. Application 3 also presented the student with all the theoretical test questions. In case of interactive applications many of these also presented the driver with a test result of the performance of the students.

Driver groups addressed

The target groups were either novice drivers or professional drivers. The Dutch application were used to update experienced drivers. One of the Czech (4) and the British (7) applications were solely developed for professional drivers.

The European project TRAINER made an internal survey covering the use of multimedia tools for driver training. 17 applications were identified. Though the applications varied substantially according to content and advancement they were directed towards either novice or professional drivers (Hoeschen et al, 2001).

Platform

All applications were PC-based. The Austrian programme were an Internet based web-page used through PC. The other applications used CD-ROM. Application 4 and 5 were interactive programmes. In addition application 5 were also available trough video or the Internet. Application 7 were used at TRL's TruckSim facility.

13 of the applications identified in TRAINER were PC-based software sold as CD-ROMs, whereas 2 were PC-based but were built up as simulators. 2 were based on CD-1 player without a TV but requiring a TV (Hoeschen et al, 2001).

Period of use

The length of usage between the applications varied substantially from less than one year to 8 years thus some of the programmes had been altered or updated quite substantially. The German application stated that improvements in the PC-technology had improved some the programmes making it possible to use on-line training within the last 12 months..

Evaluation of the applications

None of the applications had been evaluated scientifically. Most of the applications, 1, 3, 4, 5 and 6 were all based on existing theoretical training curriculum Thus it could be stated that content would be relevant though there is no indication of whether the students using the application actually benefits from it or whether there is a superior training gain through the multimedia. This was the case for both learning potentials or the transfer effects. The German and Dutch applications had been evaluated internally. In the Dutch application through dialogue with the users thus giving the driving instructors an Impression of which parts of the test that caused most difficulties.

From the TRAINER project it is not stated whether the applications had been evaluated on scientific premises.

Discussion and perspectives

Compared to the driving simulator survey relatively few institutions were involved in e-learning applications. However, this should not be taken as an indication of less profound use of these applications.

It is likely that e-learning applications are more widespread than the two surveys would indicate. When including the TRAINER survey an additional 17 applications were identified. Secondly, e-learning applications can be considered as a cost effective training tool to use, both for development and running, for any purpose such as increase specific knowledge, raise awareness or simply illustrate certain traffic situations thus making it an attractive product for commercial developers of driver training. Thirdly, e-learning applications can be used in conjunction to other training courses or as activity in simulator courses thus it is likely that a substantial amount of applications already exists on topics related to driver training or safety e.g. defensive driving, hazard perception or driving fuel efficiently. It is however beyond the scope of this survey to give answers on the extent of e-learning activities within driver training in general.

However, presently it seems as if the e-learning application have not moved beyond the existing spheres of driver training. Thus related to the Gadget-matrix the content of the training are still aimed at the control and manoeuvring tasks. Similarly conclusions were drawn from the TRAINER survey, that most of the applications did not address the strategic level of driver training to an extent desirable and thus utilising one of the potential benefits of the interactive multimedia (Hoeschen et al, 2001). However it should be emphasised that a few of the applications in both this survey and the TRAINER provided insight on the strategic and behavioural tasks e.g. through hazard perception training. However these applications were primarily targeting professional drivers.

As the applications do not seem to stand alone but are either used as a supplement or based on existing schemes they target groups of drivers who traditionally are already targeted in training, typically novice or professional drivers.

Elderly drivers, impaired drivers or drivers with special needs are not targeted in any of these applications though many of these driver groups could potentially benefit from certain elements of these applications. As a general notion it could be stated that e-learning applications potentially could have good chances of reaching these drivers as use of e-learning does not require physical presence of a driving instructor or that the drivers have to participate in traditional class-room teachings. On the other hand it could be argued that many of these groups are not familiar with these types of training tools meaning they would not necessarily be interested in this form of training. Finally it still needs to be established whether a transfer effect is actually obtained through e-learning tools

However, it is likely that as the extent of the media of e-learning becomes more and more widespread so will the e-learning applications within the areas of driver training.

The learning potential of e-learning

E-learning techniques should be regarded as an alternative or supplement to traditional theoretical training as it hold great illustrative value. On the other hand it is unlikely that e-

learning could replace real driving. This is of course not the intention as driving simulators to a large extent would be able to provide the practical training. As most e-learning applications are not yet used as compulsory training tools little knowledge exists on the learning potential compared to traditional driver training (both theoretical and real driving).

In general little scientifically validated knowledge exists on the transfer effects of e-learning in regards to driving behaviour, situation awareness or anticipatory behaviour.

Scientific requirements for evaluations of e-learning

Though these applications seem to indicate an extended use of e-learning applications several questions still remains open in order to evaluate the potential learning benefit from e-learning scientifically especially when comparing it traditional theoretical driver training.

As a general notion it can be stated that once training areas have been identified where e-learning could possible contribute to driver training a suitable scientific validation process should take place. It is of course an open question which criterions should be covered in such a procedure. However suggestions for research questions could be:

1. Are there any differences in the didactical content and processes of e-learning applications compared to traditional learning as measured by driver performance outcomes
2. Existing any results from traditional theoretical training to pinpoint weaknesses and strengths
3. Based on previous questions it should be investigated whether any areas of theoretical driver training could benefit from e-learning applications. Are there differences in the didactical processes between traditional driver learning processes and e-learning.

Before these and related question have been addressed more systematically it remains an open question whether any of the applications used within driver training have accomplished an increasing learning effect or moved beyond the spheres of existing driver training.

References

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Appendix1

Results of survey of e-learning applications

Nr.	APPLICATION OWNER	OWNER CATEGORY	CITY/COUNTRY	USES	MEDIA
1	KRONE, ÖAMTC, FÜRBOCK	Driving Schools	Vienna/Austria	Virtual driving license for novice drivers. Computer based test with questionnaire. The test is based on existing driving curriculum.	Web-page w interactive p
2	SPIS	Unknown	Prague, Czech Republic	Training of novice drivers in traffic regulations particularly in the Czech Republic and other European countries	CD-ROM
3	Jan Dobew	Unknown	Unknown Czech Republic	Training programme for novice drivers and re-training for the final driving examination. Both the curriculum and the test questions All traffic rules included as well as explanations of traffic situations at intersections	CD-ROM
4	KONTIS	Private company	Prague, Czech Republic	Training of professional drivers in traffic rules, animated intersection and other exercises. The training program	Interactive C
5	Different publishing houses in Germany	Private companies		Training for the theoretical driving test for novice and professional drivers. Programme is based on existing driving curriculum.	Video, CD-R Interactive C Web-page w interactive p
6	OCTRU (training centre of the Dutch Army)	Military driving centre	Oorschot, The Netherlands	Training novice and professional army drivers. Updating experienced drivers. Programmes are based on the official theoretical driving test	CD-ROM
7	TRL, TruckSim facility	Research Centre	Crowthorne, UK	Training of professional truck	Not availabl

				drivers on hazard perception through examples	
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Appendix 2

Result of questionnaires