COMPUTER BASED TRAINING IN DRIVER EDUCATION AND CURRENT DEVELOPMENTS ON A COMPUTER ASSISTED DRIVING TEST IN GERMANY

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ABSTRACT

This paper addresses the issue of computer based training (cbt) programs used in preparation for the German theoretical driving test. A descriptive review on current cbt programs (CD-ROM and internet applications) is given and they are compared regarding several criteria. The survey arrives at the conclusion that further research is needed on the effects of computer based training compared to traditional exam preparation with pen and paper.

The author argues that the full potential of cbt for learning drivers is not yet tapped. A special focus is laid on the potential improvement of perceptive and cognitive skills of novice drivers which could be trained with the help of appropriate cbt programs.

Opportunities for improved cbt programs in future driver preparation are expected with the introduction of a computer based theoretical driving test in Germany. Some current developments and prospects on German theoretical driving test are presented.

INTRODUCTION

In preparation to present oneself at the driving test in Germany the learners need to participate in the compulsory instruction at driving schools. Doing this, learner drivers need to attend at least 12 teaching units of basic theoretical instruction of 90 minutes each as well as two more teaching units of licence category specific knowledge (e.g. specific knowledge for driving licence category B, cars).

The German compulsory driver education in driving schools should not simply enable learner drivers to pass the theoretical driving test – which consists of a multiple choice test of 30 questions – but the main objective is to provide the young drivers with sufficient knowledge and skills for safe traffic participation.

Sole training for the theoretical driving test (tick correct answers) by no means should be the matter of the regular driving schools' instruction. The instruction in

driving schools should primarily constitute a responsible and risk-conscious driving behaviour.

Although pure practise of theoretical driving test questions is forbidden in the official driver training, learner drivers are very eager to practise the best possible way for the final exam. Several publisher companies offer materials to practise quite similar to the sheets used in the final examination. With the help of this material learner drivers could practise at home, or in the driving school before or after the regular instruction courses. Currently there are three different ways for learner drivers to practise for the theoretical test: practise exercises with pen and paper (the “traditional” way), practise examination questions with the help of a PC program (generally on CD-ROM, latterly with PDA devices like Palm OS handhelds), or practise online on special internet sites provided by publisher companies.

COMPUTER BASED TRAINING PROGRAMS FOR THE PREPARATION FOR THE THEORETICAL DRIVING TEST

In the past, learner drivers could only practise with paper sheets for the final exam. Recently, like in many other fields, computer assisted learning programs become accepted within the field of driving education as well. Several publishers distribute computer based training programs on CD-ROMs to support learner drivers in their preparation for the theoretical driving test. Driving schools as well are interested to integrate these new technologies and to use them during the exercise phases. Generally there seems to be a remarkable demand for computer aided exam preparation in the population of young learner drivers. Therefore it seems appropriate to take a closer look upon these computer based learning programs. The following study gives an overview on available learning programs in Germany and discusses possible benefits as well as perils. A brief description of the training programs and additional features will be given and the programs will be compared regarding diverse specifications.

ADVANTAGES OF COMPUTER BASED TRAINING IN DRIVING EDUCATION

A basal question is: Do we need computer based learning tools in drivers’ education? And following that: What effect can the computer based training-tools have on the learning process and in what way can learners profit from these new tools?

In context of a survey of existing training methodologies, the EU project TRAINER (System for driver Training and Assessment using interactive Evaluation tools and Reliable methodologies) states the following advantages of computer based multimedia tools compared to traditional instruction (Bekiaris, Groot, Van Aerschot & Vandenberghe , 2001):

– it is more instructive and realistic
– it is more fun to learn using such a tool
– the use of videos and pictures simplifies learning
– young people are attracted by multimedia applications

– all sensory channels of the trainee would be activated
– a good multimedia presentation might be more convincing than a trainer (who also possibly is not a very good one)
– training could be supported everywhere (at school, at home, etc.), at least for repetitions – better training overview
– much more scenarios can be economically supported than in a simulator
– better feedback on errors is provided to the trainee
– the trainee can experience more complex situations using such a tool than the trainer could describe
– lessons can be easier standardised (with guaranteed minimum quality)
– it can support distance learning
– it supports interactive education, that is optimal
– it would be less boring
– students will be more involved in the lessons
– it would support objective trainee assessment
– training can be self-paced
– much more training scenarios can be supported
– everyone has a PC, thus can self-use it, thus reduce training cost through self-training
– tailored training to trainees with particular problems can be supported
– the trainer would be guided and supported in his/her task
– appropriate emphasis to most important issues is guaranteed

This impressing list gives a very optimistic view on computer based training-tools, but you have to bear in mind, that these general advantages alone do not automatically assure successful learning in practise.

To make use of multimedia tools, the quality of the computer based training-tool is of great importance and there might exist a broad range of different quality levels. In the following some quality features of currently available CD-ROMs and internet sites will be investigated (and compared to the traditional paper/pencil technique).

OVERVIEW ON AVAILABLE TRAINING SOFTWARE IN PREPARATION FOR THE THEORETICAL DRIVING TEST IN GERMANY

The survey at hand examines the quality of computer based training-tools to be used by learners in preparation for the German theoretical driving test. The following section gives an overview on available CD-ROMs for preparation for the theoretical driving test, followed by an overview on available online offerings.

The sample of relevant CD-ROMs was compiled by looking up popular internet sites which provide a product-price-comparison on selected topics. The search was made in the category “software” using the keyword “driving licence”. To verify the results given, an additional online market place was scanned with the keywords “car” and “driving licence” in the rubric “Software”. Finally the internet sites of appropriate publisher companies for driving school teaching-material were scanned for corresponding software.

Further on only current versions of the programs are considered, apparently older versions like a program titled “Führerschein 2003” (driving licence 2003) were dropped out and are not considered in the survey.

Table 1 gives an overview on the located training software CDs to be under examination.

Table 1: Overview on currently available CD-ROMs in terms of “driving licence test training” in Germany (alphabetic order) considered in the survey

Application	Publisher	Price (cheapest offering)
Der neue Führerschein Trainer 2004/2005	Franzis	19,95 €
EU- Führerschein 2	Koch Media	9,99 €
Euro Führerschein 2004	Franzis Verlag	21,99 €
Euro Führerschein Master 2004/2005	Topos Marketing	14,99 €
Europa Fahrschule 2004/2005	Astragon Software GmbH	14,95 €
Europa Führerschein 2004/2005	S.A.D.	9,99 €
Europa Führerschein 2004/2005	Rondomedia	13,99 €
Fahren lernen plus	Vogel Verlag	10,00 €
Fahrschul Coach	Data Becker	15,99 €
Fit für die Führerscheinprüfung	Axel Juncker Verlag	5,95 €
Fragen-Lern-CD	Wendel Verlag	Price not known
Führerschein 2004	Tewi	13,99 €
Führerschein erwerben	Hörzu Software	8,00 € (second hand)
Führerscheinprüfung, Fragenkatalog auf CD-ROM	Let’s drive GbR	9,00 € (second hand)
PC Fahrschule	Publisher not known	1,00 € (second hand)
RTL Führerschein – Der große Führerschein Test	Koch Media	13,99 €
Sicher und einfach zum Euro-Führerschein	Franzis	34,95 €

These 17 programs named above were compared regarding:

- considered driver license categories
- topicality (on July, 1st 2004 the German official list of questions for the driving test was revised and augmented)
- possible update capability
- adaptive proceeding, e.g. personalised learning sequence adapted from individual previous knowledge or possibility of personal weak points analysis
- possibility for exam simulation
- possibility for individual statistical evaluation
- additional available features beneath exam preparation

The topics mentioned above were examined because they represent possible advantages of computer based training in regard to the pen and paper method. Compared to the paper version, the cbts can easily be adjusted if the list of questions has been updated, they can provide individual (adaptive) learning sequences and provide a superior analysis of achievement. Thus these topics indicate quality characteristic of a cbt program.

Moreover the multimedia programs may particularly exceed pure training of questions for the final exam and supply the young drivers with a training of risk perception, cognition training, or the like; tasks that can not be accomplished with the traditional pen an paper practise. This features would indicate a high quality cbt program for learner drivers.

RESULTS ON THE SURVEYED CD-ROM PROGRAMS

The comparisons were made on the bases of manufacturers' general information in the programs' accompanying texts. The actual CD programs themselves were not investigated. Consequential the following statements depend on manufacturers' statements.

The condensed results are:

- All programs comprise at least learning matters for driving licence categories A, A1, (motorcycle), B (car), and M (moped). Most of the CDs also contain relevant questions for category C, C1, CE (lorries and trucks), D, D1 (busses) (all but two)
- An (internet) update feasibility is provided only by one cbt program
- The content of eight out of the 17 programs is up to date and implies the current list of examination questions as revised in summer 2004
- Seven out of 17 cbt programs provide an individual adaptive proceeding; most of them resubmit questions that were not answered correct on first attempt once again at the end of the respective learning unit
- A simulation of the driving test with questionnaires similar to those given in the actual exam is provided by 14 out of 17 programs
- Ten trainings provide a statistical analysis of the individual performance in the questionnaires

The analysis showed that all programs are mere drill and / or cram programs for exam preparation. The main aim of the CD-ROMs is to practise the potential questions comprised in the theoretical test questionnaire.

Only a minority of the programs feature an update function to keep the list of questions up to date. Yet many of the viewed programs do not even imply the actual list of questions as it was revised by the legislator in summer 2004, which means since that time they are out of date. Those programs that imply the up-to-date questionnaire advertise strongly with this feature for this is an obvious competitive advantage.

In general the programs' proceeding layout is linear and provides no specific adaptive proceeding in regard to the knowledge or abilities of the individual learner at hand. Normally there is the possibility to break up an exercise at any time without having finished all subtasks and go directly to the next exercise. That is to say, you are not forced to execute all questions of a specific topic before continuing with another topic.

Some programs provide the opportunity to present all items not worked out successfully (or skipped) during the program sequence once again at the end of each exercise. By request several programs offer the possibility to rework the incorrect answered items from a former pass sorted by subject area. Herewith a systematic processing with the former individual deficits can be realised.

Nearly all examined products contain a statistical analysis which provides the learner with a feedback on his learning level and – where applicable – about the learning improvement in the various scopes of the theoretical driving test.

Compared to the traditional paper sheets (some of) the analysed CD-ROM-training offer definite advantages concerning drill and practise for the theoretical driving test. Those questions or topics learners are supposed to still have low abilities in can be processed repeatedly and the learner will train his recall capability when he recapitulates those questions formerly answered wrong. Accordingly, compared to the paper version these cbt programs are likely more suitable to cram the learning matters.

ADDITIONAL FEATURES ON CBT CD-ROMS

In fact all considered CD-ROMs contain further functions beyond the training of the questionnaire for the preparation of the driving test, but these additions are mostly related to information or entertainment level.

The additional functions or features located on the diverse learning-CD-ROMs can be categorised as follows:

- *Legal basis*: fine calculator, fine catalogue, extract from the driving licence regulations, motor vehicle tax tables, actual legal driving exam guidelines, driving licence categories, basic tasks and rules for the practical driving test
- *Guidebook "used cars"*: prototype for contract of sale, motorcar check list, used car advisor, links to car markets on the internet
- *Background knowledge on driving education*: registration at the driving school, theoretical and practical instruction, index of track training locations
- *Information on driving in foreign countries*: speed limits abroad, toll, fuel, nationality plate
- *Technical information*: technical ABC, technical lexicon
- *Games and entertainment*: road sign mah-jongg, "highway duel" or other games, clipart dealing with cars and traffic, screen saver, blood alcohol concentration calculator

A desirable advanced training of perception, cognition, or behaviour potential relevant for the driving task is not integrated in any of the CDs. Even explicit clues about defensive driving, environmentally sound driving, safety margin, effect of alcohol and drugs, distraction while using information systems like navigation, mobile phone, or distraction from passengers, instruction in new technical systems like ABS, ESP, or AAC, behavioural advice in case of an accident or breakdown, practical hints how to change a wheel or electric bulb, considerations on the effect of weather, driving destination, and driving aim on the driving task are not considered in any of the examined CD-ROMs.

Actual driving task relevant add-ons on the CD-ROMs, that exceed the mere examination question list, are limited to an interactive traffic sign trainer, a first aid trainer and provided information on child protection in cars.

Apart from the training of the exam questions, the full potential of multimedia CD-ROMs is not tapped so far. Proper tools that exceed the exam preparation and assist future young drivers with extensive road safety knowledge, skills, or attitudes are not implied in current CD-ROMs that should support learner driver in preparation for the exam.

THEORETICAL DRIVING TEST TRAINING ON INTERNET SITES

Besides CD-ROMs learner drivers can also practise the questionnaires relevant for the theoretical driving test at internet pages. With the help of search engines, two appropriate online offers were found. For both a login name and password is necessary. A fee of € 20,- (fahrschule.de) respectively € 25,- (fahren-lernen.de) is charged and the user can practise as many questions (or “sheets”) as he wants for four months after registration. The learner drivers’ training results can be checked online by their driving teachers, thus the driving teachers can observe the learning progress of their students. At least one of the internet training provides the opportunity to associate the topics from the theoretical lessons at the driving school to the exercise part at home because the teaching and online learning materials of this publisher are interlinked and the learner can continue to study independently and exercise for oneself ensuing the instruction part at driving school.

One publisher company makes the online training available in eleven different languages. These are the selected languages in which the German official theoretical driving test can be passed by foreigners in their native language.

An apparent advantage of the internet training offer is the expense: Compared to the record of paper sheets which cost from € 45.- to € 60.- learners only need to pay half the price.

Like in the CD-ROM programs mentioned above the online training programs offer solely a preparation for the theoretical driving test. These programs only focus on the “exam relevant traffic knowledge” of the learner.

RÉSUMÉ

The study showed that the main application of the considered computer aided training used in driver education is the preparation for the pass of the theoretical driving test. The learner is trained to give right answers in a multiple choice test. It is safe to say that the customer gets exactly what he wants: assistance to memorise the examination questions. Contents and formats of the exercise material on CD and internet application are similar to the paper/pencil version and thus the official driving test.

Some training programs assist the learner with an adaptive and individualised proceeding by presenting those items again, that were previously answered incorrect. This feedback for the learners' learning status is a feature that can not be delivered by traditional paper sheet exercises. Also the multilingual design certainly is an advantage of the computerised training. Regarding the price of the material, CD-ROMs as well as internet applications are at lower price than exercise paper sheets. Whilst the set of paper sheets can only be dealt with once (apart from erasing the written answers from the sheets again), within the computer based training the items can be provided as often as you like (on internet application within four months).

At first glance a lot of advantages seem to argue for the computerised versions for exam preparation. Although in this study only manufacturer's descriptions and instructions were analysed, varieties in quality of several products can be found. The impact of these quality differences on learners' success remains unexplained in our study.

In future the actual CD programs and their matters should be investigated and categorised with a fixed model for quality characteristics. Based on this objective quality classification system further research should be done on the question how effective computer aided training programs are compared to the traditional training technique with pen and paper in regard of the specific exam outcome. In Germany, yet there are no scientific studies reporting an assessment of relative learning results or equivalence studies comparing conventional training with traditional paper version vs. computer based training programs for the driving test.

For the future BASt plans to conduct such scientific studies referring to the educational effects of computer based training for learner drivers compared to traditional instruction and learning.

OUTLOOK

The computer as a training tool in driver education implies much more potentials than sole goal-orientated learning or practise of examination questions. Though traffic rules and the basic operation of a car can be learned in about 15 driving lessons (Hall & West, 1996) it is commonly known that safe participation on road traffic requires much more than vehicle operation abilities or mere knowledge of traffic rules.

In particular perceptive and cognitive skills are very important – especially for novice drivers. For instance the hazard perception abilities or the risk awareness as well as the attention / concentration capability and the speed of information processing of novice drivers could be skilled with the help of corresponding multimedia computer programs (as they are used in Australia). Unfortunately until now there is no such exhaustive training program for learner drivers and novice drivers available in Germany.

Maybe the upcoming improvement of the German theoretical driving test (cp. BASt project report “Optimierung der Fahrerlaubnisprüfung”, optimising driving licence test, Bönninger & Sturzbecher, 2004) will accelerate this process. It is intended to replace the current paper based exam with a new computer based examination and to enlarge the variety of test topics. As a consequence, also skills and abilities like hazard perception or risk awareness could possibly be checked within the theoretical driving test.

STARTING POINTS FOR AN OPTIMISED GERMAN DRIVING TEST

As a result of the BASt research project mentioned above, three starting points for an improved German driving licence test can be stated:

1. Basis of the improved theoretical driving test is the scientifically established design and development of the test items (e.g. accident statistics, new item contents resulting from characteristic accidents types of novice drivers)
2. The utilisation of computer and the use of its extended multimedia potential enables newly designed test items with new formats (like computer animation) and response possibilities (e.g. clicking on picture)
3. Quality assurance of the whole test system and ongoing evaluation of currently used and newly developed test items shall enhance the performance of the driving test

With the use of computer technology and multimedia (like computer animation or film sequences) the performance of the German driving test shall be increased: new types of examination questions become feasible and following that the range of testable competencies will be expanded. Here attention should be paid to fundamental competencies important for novice drivers’ driving behaviour. Particularly novice drivers’ skills in perception, their abilities in cognitive information processing and the knowledge where risks may appear are deficient (Engström, Gregersen, Hernetkoski, Keskinen & Nyberg, 2004). The test of these fundamental skills – useful for hazard perception and hazard prevention in traffic – should be integrated in the revised German driving test and more value should be attached to these skills in driver education, for these are abilities which in fact can be trained (McKenna & Crick, 1997), especially with the help of innovative computer based training programs.

DEVELOPMENT GUIDELINES FOR A NEW GERMAN THEORETICAL DRIVING TEST AND IMPACT ON FUTURE DRIVER EDUCATION

The future computer based driving test to be developed should improve the efficiency of the theoretical driving test as it is based on scientific proceedings (i.e. empirically founded exam question and test format development) which provides improvements in regard to content as well as methodical aspects. Valid test contents just as reliable test formats combined with a systematic quality assurance and a continuous optimisation of the whole test system are guidelines for the development of a revised German driving test. The use of computer and multimedia technique allows improvement opportunities of the whole testing process, especially as it enables new test topics that offer valuable clues on the learner drivers' traffic related competencies.

Subsequent of this revised driving test, the exam preparation of the young drivers will be improved, and more innovative training techniques build on computer assisted training may successively enter the market of German driver education. The extended knowledge gained with these computer based training tools will hopefully help the young drivers with their qualified, better educated, and therefore accident-free start into sustainable safe mobility.

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