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Simulation: Proven Effective for Training Drivers

"Learning is by doing. If you can't do it before you do it, expect to learn it as you do it."
- Anonymous NASA employee

History of Simulator-Based Training

There is a long list of scientific literature on simulators and their use for training that dates back to 1950s. For decades, simulation has proven to be an effective training tool for the military and first responders. Air Force, Marine Corps, the Army and Navy have trained their airmen, sailors and soldiers in the rules of engagement, judgment, combat, marksmanship and indirect fire on simulators. Before pilots fly the world's most advanced fighter jets, they fly first on simulators. Helicopter pilots benefit from simulator technology by improving their overall readiness at an earlier stage of their rotary wing training. Simulation provides for reduced costly flight hours and improved safety and training outcomes. Emergency vehicle operators use simulators to learn safe driving maneuvers in emergency response situations without endangering themselves or the public. Each is completely safe, because they can crash on a simulator, and live through it. Each is more technically proficient, safer and mission-ready.

Do Simulators Provide Effective Training for Drivers? Yes!

"Simulator training can prepare drivers to respond appropriately to hazardous conditions and thus avoid accidents."
- NTSB Chairman Jim Hall

Recent research has investigated the training benefits that driving simulators provide. there is compelling evidence that simulator-based instruction provides a high transfer of learning rate on new and experienced drivers. Moreover, it has been proven that ***making mistakes*** is a key dimension to learning. Flach et al. (2008) stated: "This is likely to be one of the values of simulators – they offer an opportunity to learn from mistakes in a forgiving environment"[1].

[1] *Flach, J.M., Dekker, S., & Stappers, PJ (2008). Playing twenty questions with nature (the surprise version): Reflections on the dynamics of experience. Theoretical Issues in Ergonomics Science. 9. 125-154*

Key Results of Driving Simulator Research & Studies: Fleet Driving Programs

Research Finding	Source/Study
"Simulators can prepare drivers to handle unpredictable or safety-critical tasks that are inappropriate to practice on the road, such as collision avoidance or risky driving (Hoeschen et al., 2001)" "In these days of high-priced fuel, simulators provide a cost-effective solution to initial driver training. Besides financial benefits, simulators offer great opportunities for carrying out objective measurements on the user's actions in a safe and purpose-developed virtual environment (Vlakveld, 2005b)." "Simulators provide complete control over training conditions. Behavior of other vehicles, weather conditions, or the virtual environment can be manipulated in real time according to training needs (Wassink et al., 2006)." "Virtual environments are purpose-developed as well, making it possible to practice many maneuvers in a short training session." "A driving simulator can measure performance automatically, objectively, and accurately. Simulation data can be used for objective diagnosis of student performance, statistical analyses and predictions of future driving performance."	Dr. Ir. Joost C. F. de Winter, Department BioMechanical Engineering, Delft University of Technology, The Netherlands.
"According to Brock et al (2011) reported that simulators are also able to replace some of the hours spend in the actual vehicle. This can have a significant impact on training costs, as simulator costs can run as low as $3 per hour per student vs. $40 per hour per student for in-vehicle training. " "Schneider National in Green Bay, SI implemented a technology-based program for entry-level commercial drivers that included classroom, simulation BTW and computer based instruction. They reported that their 0-to-90 day accident rate decreased from 31% to 10% and that for each 1-day reduction in training time, saved $7,000,000 annually. " "Brock, Jacobs and McCauley (2001) noted that the use of simulation reduced training time in one agency from 19 days to 17 days by replacing classroom bus training with simulator training. In another agency, using simulation reduced training time by 5 days." "Brock et al (2001). "In particular, simulator training validates defensive driving techniques taught in the classroom, provides an opportunity to experience hazardous situations without putting the students or the bus at risk, reinforces proper driving habits and defensive driving principles, and allows instructors to check reaction time, eye- hand coordination, and driving skills."	*Effectiveness of commercial motor vehicle driver training curricula and ...* By John F. Brock, United States. Federal Motor Carrier Safety Administration. Brock, Jacob & McCauley 2001

Research Finding	Source/Study
"The California Commission on Peace Officer Standards and Training Driver Training Study found that Driver training that utilizes a driving simulator result in nearly a 10% reduction of traffic collisions." "Based on data from the POST study, blended training using both behind-the-wheel and simulators produced the best training outcomes."	*California Commission on Peace Officer Standards and Training Driver Training Study*
"Changing from classroom instruction to simulator-based training resulted in a 75% reduction in critical errors (not to mention a safer environment on the track for the drivers and instructors!)." "The reduction in critical errors can be attributed to the fact that the simulators presented much more hazardous conditions than could be recreated safely and reliable using real vehicles on the track." "The objective measure for risk reduction could prove to be very significant in future evaluation of return on investment."	*Analysis of Simulator-based Training Effectiveness through Driver Performance Measurement*. Darrell Turpin, Reginald Welles, Applied Simulation Technologies
"AAA Foundation for Traffic Safety has recently sponsored a research program on evaluating driver education programs (Lonero and Clinton 2006). Although specifically aimed at commercial driving training enterprises, early data indicate that well designed CBI, including simulation, can improve student performance."	*Large-Scale Evaluation of Driver Education view of the Literature on Driver Education Evaluation 2010 Update*. Lawrence Lonero, Northport Associates, Dan Mayhew/Traffic Injury Research Foundation for the AAA Foundation for Traffic Safety.
"Simulation technology can potentially provide experience over a significant portion of the driving task, involving behaviors including sensory-perceptual, psychomotor, cognitive, and time-sharing/divided attention skills." "A simulator with good scenario control can teach the range of cognitive skills required to deal with complex roadway and traffic conditions including appropriate situation awareness, hazard perception, decision making under time pressure and general defensive driving techniques." "A simulator can safely provide repeated exposure to complex hazard situations, and give drivers experience in the perception and decision making required to deal with them effectively." "Based on data from the experiment, total accidents decreased with experience in the simulator. Novices had twice as many accidents in their first session as the experienced drivers, and the novice accident rate dropped to near that of the experienced drivers in the second session. It is this two way interaction between driving experience and session that suggests some utility to novice driver simulator training." "This suggests that a simulator can provide training to reduce accidents in complex and critical road/traffic situations."	*Low Cost PC Simulation Technology Applied to Novice Driver Training*. R. Wade Allen, Marcia L. Cook, Theodore J. Rosenthal.

Research Finding	Source/Study
"In one 18 month study, researched the effects of simulators on driver training performance. 92% of the training managers using the bus simulators expressed a 'high level of satisfaction with their training simulator'." "Trainers rated bus simulator training high in the areas of effectiveness in training first-time drivers and utility in the overall training curriculum. When asked if the simulator is more effective than traditional training for teaching certain types of knowledge, skills, or attitudes, 58 percent of respondents reported that the simulator is more effective than traditional training methods." "All respondents believe that the simulator training provides an excellent opportunity to experience a hazardous situation without actually being in a hazardous situation." "Although this study concentrated on driving simulators for transit bus operators, the study techniques and basic guidelines will apply to any driving simulator evaluation. By linking specific tasks and skills to simulator characteristics, training managers can acquire the simulation technology they need."	*Design of a Guidebook for the Acquisition and Use of Driving Simulators for Training Transit Bus Operators*. John Brock, Cynthia Jacobs, Richard Buchter, Milestone Group.
"Another study reviewed the effectiveness of simulator based training. The Texas Association of Counties had goals of using a simulator to reduce auto liability and workers' compensation claims. After training 2,000 law enforcement, road and bridge truck drivers and other county drivers, they have reduced auto liability claims by 55%. Additionally, they reported an 18% reduction in occurrences for the 21-month period since using simulator-based training." "Simulator based training is not the least expensive method of training and the initial cost is a concern, but as more drivers are trained the cost per participant becomes more in line with other forms of driver training. The unique aspect of simulator based training is that you can totally destroy a car in a collision, but with a click of the mouse you are back in business and no one is injured."	*Preliminary Results – Simulator Based Training to Reduce Costs*. Paul Hoff. May 2002.