

Comparison of head-up display (HUD) vs. head-down display (HDD): driving performance of commercial vehicle operators in Taiwan.

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# Comparison of head-up display (HUD) vs. head-down display (HDD): driving performance of commercial vehicle operators in Taiwan

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### Abstract

This study investigates the effects of two different display modes—head-up display (HUD) vs. head-down display (HDD) on the driving performance and psychological workload ratings of drivers operating commercial vehicles in Taiwan. Twelve commercial lorry drivers participated in a 2 (high/low driving load road) × 2 (head-up/head-down display) × 2 (different arrangements of display sequences used) mixed-factor driving simulation experiment. Participants were divided into two groups according to the level of driving load conditions within each driving load group; the participants were further divided into another 2 subgroups based on two arrangements of display sequences used.

For each driving load condition, there were two 20-min driving simulation experiments, separated by a display sequence using head-up first and then head-down or vice versa. The subjects were asked to perform four tasks: "commercial goods delivery", "navigation", "speed detection and maintenance" and "response to an urgent event". Results indicated that for the first task, commercial goods delivery, the two display types showed no significant performance difference in terms of average accuracy rate. However, in terms of response time to an urgent event, it was faster with the HUD (with a low driving load"head-up vs. head-down: 1.0073 vs. 1.8684 s; with a high driving load"head-up vs. head-down: 1.3235 vs. 2.3274 s) and speed control was more consistent (having low speed variations) than with the HDD. In addition, using the HUD caused less mental stress for the drivers than the HDD and was easier for first-time users to become familiar with; with a high driving load, however, the difference between the two displays was not significant.



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