

Device agnostic digital Digit Symbol Substitution Test (DSST) for use on smartphones and tablets

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Methodological Issue Being Addressed Investigating comparability of Digit Symbol Substitution Test (DSST) data collected remotely using a smartphone device and in-person on an iPad, in order to expand administration options for digitized cognitive tests across remote and in-clinic clinical trials settings.

Introduction DSST is a widely used cognitive test examining domains including associative learning, attention and executive function. The traditional version is a written test with the main outcome measure being the number of correct patterns drawn by participants within 90 seconds. Digital versions have been developed to explore more efficient and convenient options for cognitive assessments, with richer outcome measures available.

This abstract aims to investigate the comparability of digital DSST data collected on a smartphone vs an iPad, to complement the previous work on comparison of DSST between smartphone version and traditional written version.

Methods Participants aged 18-80 with approximately equal number of males and females completed DSST in two studies using either smartphone or iPad devices. Sample sizes are sufficient for comparison with $n = 146$ for smartphone data and $n = 198$ for iPad data.

In addition to the main DSST measure, total correct patterns completed (DSTTC), we can additionally examine mean (DSTCRLM) and standard deviation (DSTCRLSD) of reaction time for successfully completing the patterns based on the digital test.

To mitigate potential confounding factors of age and gender between studies, we examined device comparability in DSST measures using t-tests and Cohen's D in four demographic subgroups (female under or above 40, male under or above 40), and tested for device differences using an ANCOVA analysis adjusting for age and gender.

Aging is expected to impact DSST performance. We therefore examined age slope differences by device, looking at age and device interaction effects using ANCOVA adjusting for gender, to understand whether associations between age and DSST measures are impacted by device.

Results DSTTC and DSTCRLM showed negligible to small differences of device (Cohen's $D < 0.5$) with no significant t-test results ($p > 0.05$) in all demographic subgroups. DSTCRLSD showed the

same patterns in all but one subgroup (male above 40), where there was a moderate and statistically significant difference (Cohen's $D = 0.6$; $p = 0.015$).

In ANCOVA tests on device differences, there was no significant difference in DSTTC ($p = 0.153$), but the differences were significant for DSTCRLM ($p = 0.002$) and DSTCRLSD ($p = 0.003$). In ANCOVA results for age slope differences, there was no significant difference for any DSST measure ($p > 0.05$).

Conclusion In summary, the main outcome measure DSTTC has good comparability between the devices studied, despite there being some differences in the more detailed reaction measures. These differences are potentially due to device hardware latency difference. The relationships between age and DSST measures are not impacted by device, indicating consistent measure sensitivity by age across devices. In conclusion, these results validate comparability of digital DSST for use across devices, though comparisons of reaction time should be made with caution if different devices are used for test administration.

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