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Toward Age-Inclusive Virtual Learning Environments: Evidence from Older Adults' Evaluation of Desktop VR Navigation

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Abstract

Virtual reality (VR) is increasingly integrated into education and training; however, navigation interfaces may pose challenges for older adult users, whose interaction requirements are often underrepresented in technology evaluations. This study investigates the experiences of older adults with IntuNav, a desktop VR navigation technique utilized in a Multi-Browser Virtual Environment. It identifies factors pertinent to the design of age-inclusive virtual learning environments. Thirty-one participants aged 60 to 75 years engaged in navigation tasks and assessed the system using the System Usability Scale (SUS), measures from the Technology Acceptance Model for perceived usefulness (PU) and perceived ease of use (PEU), as well as raw NASA-TLX scores, in addition to task completion time and navigation errors. Descriptive statistics and Spearman's rank correlations were employed to characterize user experience and to analyze associations among perceived usability, technology acceptance, cognitive demand, and performance. Overall usability was high ($SUS = 85.40 \pm 7.10$). Participants reported high perceived usefulness ($PU = 5.91 \pm 0.82$) and ease of use ($PEU = 5.93 \pm 0.57$) on seven-point scales. SUS was positively associated with both PU (Spearman's $\rho = 0.410$, $p = 0.022$) and PEU (Spearman's $\rho = 0.385$, $p = 0.033$). Higher perceived cognitive load was also associated with more navigation errors (Spearman's $\rho = 0.521$, $p = 0.003$). These findings indicate that perceived usefulness, ease of interaction, and manageable cognitive demands are critical factors in the design of desktop virtual environments aimed at enhancing inclusive participation of older adults in digital learning and lifelong learning contexts.

Keywords: Accessibility; Assistive Technology; Human–Computer Interaction; IntuNav; Usability