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# COGNITIVE LOAD AND GAME PREFERENCES IN THE GAMIFICATION OF NEUROREHABILITATION-CENTRIC HAND EXERCISES IN CHRONIC STROKE

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**Background:** Motivation and engagement are important factors to consider in the context of stroke rehabilitation. Enhancing both factors can lead to improved program adherence and therefore better rehabilitational outcomes for stroke participants. When exploring techniques to increase rehabilitation program appeal, gamification continues to be a popular means to enhance often mundane rehabilitative activities with proven results. Gamification applies game mechanics to non-game contexts to better engage audiences.

**Methodology:** Five gamified rehabilitative interfaces were developed and tested against a default non-gamified interface associated with hand function rehabilitation device (MyHand®). Participants with chronic stroke (Mean age: 54.4 ± 12.6 years, years since stroke: 2.3 ± 1.6 years) engaged in hand function training for 10-weeks. All participants completed a NASA-TLX questionnaire after each training session to help estimate cognitive load associated with the counterbalanced interface they interacted with. Total elapsed play time of each interface was also collected. Participants completed up to 24 sessions in total, with a maximum of 90 minutes of hand function training. For the first 30 minutes, participants trained using the non-gamified interface. For the following 60 minutes, one of 5 gamified interfaces or the non-gamified interface was interacted with. Breaks were included throughout the session. Pre- and post-assessment sessions were conducted with each participant before and after the intervention, capturing behavioural data. During the post-assessment session, participant game preference rankings of all six interfaces were also collected.

**Results:** The default non-gamified interface was consistently ranked as the least preferred interface among all participants (Interfaces were calculated to possess a preference weighting value between 7 to 42, the non-gamified interface had the lowest value of 7 whereas all gamified interfaces were between 21 and 37). In addition, the gamified interfaces, consisting of added complexity to incorporate game rules, themes, and strategy, did not add any additional cognitive burden onto participants compared to the default, non-gamified interface (no significant difference in cognitive load between gamified and non-gamified interfaces – $p>0.05$). Averaged weighted NASA-TLX scores confirmed the default non-gamified interface presented higher cognitive load score associated with gameplay compared to every gamified interface.

**Conclusion:** Overall, the preference for gamified rehabilitative interfaces and their decreased cognitive load was observed to be more effective in increasing potential adherence to stroke-based hand rehabilitation training.