

08 ORIGINAL RESEARCH

Acute Effect of Different Exercise Modalities on Working Memory and Motor Learning of a Golf Putting Task

Chih-Chia Chen

Mississippi State University, USA

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ABSTRACT

Background: Several studies so far have demonstrated that physical activity could lead to improvements in executive function and performance. To date, much of the work in this area has been built on the influence of acute bouts of physical activity. This study was going to compare the effects of skill random practice and acute cardiovascular exercise on visuospatial working memory (VSWM) and golf putting performance.

Method: 24 healthy adults (10 males, 14 females, aged 21.02 ± 0.70 years) with no golf experience participated in the study. A set of baseline measures was administered, including two VSWM tests (i.e., memory matrix and rotation matrix) and a 10-ft. golf putt task. Then, a 30-min intervention was implemented after the baseline period. Participants were randomized into two exercise groups: skill random practice and acute cardiovascular exercise. The skill random group practiced 3 blocks of 3 feet, 6 feet, and 9 feet putts. Each block had 10 trials of putting, so the total number of practice trials was 90. The acute cardiovascular exercise group participated in a 30-min treadmill exercise, maintaining their heart rate between 65% and 85 % of their predicted maximum heart rate (HRmax). An acquisition measure after the intervention and a 24-hour retention measure were given. Data were analyzed by separate analyses of 3 (time periods) x 2 (groups) ANOVA.

Results: The scores in working memory tests were improved immediately after the intervention; however, the improvement in retention effect of VSWM was not maintained. Inconsistent with our findings in moderate-intensity exercise, the advantageous effect in 24-hour retention seemed to be noted in the high-intensity acute exercise studies. Therefore, more studies are still needed to differentiate the mediation effect of intensity of exercise on working memory. In addition, golf putts were seen to improve 24 hours after practice compared to the baseline. It could be possible that the effect of the underlying fatigue in the low extremities on the treadmill may hinder the short-term recall of the motor memory and thus mask the movement regulation of upper extremities (i.e., golf grip, arm swing) later in the golf putting task. The coexistence of facilitative and hindering mechanisms from walking might explain why exercise did not enhance motor skill acquisition immediately. Moreover, no

group difference was noted between skill random practice and acute cardiovascular exercise during acquisition and 24-hour retention tests. While performing skill random practice in golf putting, participants spent much time practicing fine and gross motor coordination, such as visual search, eye-hand coordination, balance, and spatial orientation. These motor abilities demand higher-level cognitive processes and are likely to be related to attention and managing visual and spatial information that resulted in positive effects. The present study provides a proper level of contextual interference that would offer participants the opportunity to make adjustments during practice and may be beneficial for learning motor skills.

Conclusion: Although the results suggested several promising findings, adding a longer duration of retention test, such as a 7-day retention test, would enable subsequent studies to investigate this area of interest more thoroughly. The present study is one of the pioneering studies that has attempted to pair acute cardiovascular exercise, executive function, and complex motor skill learning. The evidence suggested different temporal effects on VSWM and golf putting learning. The implication of this study is to address the importance of daily physical activity for facilitating better learning and memory for young students, as well as motor rehabilitation for older adults.

Author Information

Chih-Chia Chen, Ph.D., <https://orcid.org/0000-0001-6963-3795>

Associate Professor, Department of Kinesiology, Mississippi State University, USA.

Email: cc2196@msstate.edu



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