

14%; pivot 34%) compared to pre-planned (cut 3%; pivot 4%) were observed. Significantly ($P = 0.038$, $\eta^2 = 0.42$) greater final/penultimate peak horizontal GRF ratio was observed during unanticipated pivots (1.25) compared to pre-planned (0.89). The results illustrate that less braking takes place during penultimate contact of unanticipated cutting and pivoting compared to pre-planned, highlighting the need to develop players' anticipatory skills to allow more time for technical adjustments prior to final contact to help lower hazardous knee joint loads during final contact.

Successful transfer of a learning strategy to a novel sporting task

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The five-step learning strategy (FSLs) has been demonstrated to enhance the learning of novice adults and children on a range of closed motor skills (Lidor, and Singer, 2005, In D. Hackfort, J. L. Duda, and R. Lidor (Eds.) *Handbook of Research in Applied Sport and Exercise Psychology: International Perspectives* (pp. 109–126)). It is not known, however, whether children who were taught the FSLs can retain the knowledge of the strategy over a prolonged interval and then successfully apply the strategy on a novel task. Understanding children's capacity to retain and independently apply the strategy would provide useful guidance for PE teachers and coaches who wish to enhance the quality of their practice sessions. With institutional ethics approval, 20 children (mean \pm s age: 14.5 ± 0.4 years) were randomly allocated to an FSLs group or a control group. All the children received three 1-h practice sessions on a modified basketball shooting task delivered by the second author. In addition, children in the FSLs group were taught the strategy while those in the control group received information on the history of the free throw. One month after this initial acquisition phase, the children's regular PE teacher introduced the children to the transfer task (golf putting) during a PE lesson. For all the tasks, performance accuracy, completion times and researcher-devised questionnaires regarding thoughts and strategies during practice were recorded. The children in the FSLs group also completed a researcher-devised questionnaire testing their knowledge of the FSLs at the end of the acquisition and transfer phases. A two-way (group \times trial block) ANOVA indicated a significant interaction

during acquisition ($F_{9,162} = 3.229$, $P = 0.001$), with the performances of the FSLs group improving at a faster rate than those of the control group. On the transfer test, a two-way (group \times trial block) ANOVA revealed a significant main effect of group ($F_{1,18} = 11.54$, $P = 0.003$), indicating consistently superior performance by the FSLs group. In addition, the completion time for the FSLs group was significantly longer than that of the control group during both acquisition ($F_{1,18} = 157.9$, $P < 0.001$) and transfer ($F_{1,18} = 33.6$, $P < 0.001$), suggesting that the FSLs group implemented the strategy. Questionnaire results indicated that children in the FSLs group applied the majority of steps on both acquisition and transfer (acquisition median = 5 steps, transfer median = 4 steps), while recall of the individual steps varied from 90% to 100% after acquisition and from 70% to 100% at transfer. In conclusion, children who were taught the FSLs successfully recalled and applied the strategy after an interval of 1 month and in so doing demonstrated superior performance on both acquisition and transfer tasks relative to a control group. PE teachers and coaches should consider introducing the FSLs as a means of enhancing the learning of closed motor skills.

Changes in muscle burst activity during a 100-m breaststroke swim

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One of the factors that determine performance in swimming is the ability of the central nervous system (CNS) to co-ordinate the activation and deactivation dynamics of muscle force development and relaxation (Billaut et al., 2005, *Neuroscience Letters*, 380, 265–269). Changes in stroke kinematics have been previously reported in breaststroke swimming (Thompson et al., 2000, *Journal of Sports Sciences*, 18, 421–431). It has been reported (Pai et al., 1984, *Journal of Sports Sciences*, 2, 225–239) that a decrease in stroke rate could be associated with a compensatory mechanism which could reflect a diminution of neural activation; this has been partially validated (Caty et al., 2007, *Journal of Electromyography and Kinesiology*, 17, 285–291) in front crawl swimming; however, there is nothing currently in the field of breaststroke swimming. The purpose of this study was to investigate changes in the amplitude and duration of muscle activation of key upper and lower extremity muscles