Distribution of Practice on Cup Stacking Performance

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Abstract

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Cup stacking is an activity in which participants stack and un-stack specially designed plastic cups in pre-determined sequences. Preliminary research, although limited, has found some support for claims made by the manufacturer that the activity improves coordination by improving ambidexterity, developing hand-eye accuracy, and promoting upper extremity quickness (*Speed Stacks, Inc.*, 2005). Many physical educators have started cup stacking programs in their schools, however, little research has been conducted to examine how best to address practice structure for this activity. The purpose of this study was to test two separate techniques of practice on cup stacking performance. Thirty volunteer participants ranging between 19-27 years old, all of whom had no prior training or experience in cup stacking, were randomly assigned to the massed (n=10), distributed (n=10), and control (n=10) practice sessions. The massed group practiced a series of stacking sequences for 60 consecutive minutes. The distributed group, practiced for three 20-minute sessions. The control group did not practice cup-stacking. All groups were pre- and post-tested on reaction time (RT), using the same Yardstick test as reported by Udermann, Mayer, Murray and Sagerdorf (2004). RT data were analyzed using a 3 (Group) x 2 (Test) mixed ANOVA. There was a significant interaction (Group x Test), $F(2,27)=8.910$, $p<.05$). LSD post hoc analyses revealed that only the massed and distributed groups improved their reaction times following the 1-hour cup stacking practice. Cup stacking performance between these two groups was compared by examination of stacking time for three sequences (6; 3-6-3 and 6-6) with the latter sequence serving as a transfer test. A 2 (Group) by 3 (Sequence) mixed ANOVA was used. There was a significant Group main effect ($F(1,18)=9.318$, $p<.05$) with faster stacking times exhibited for the distributed group. There was no significant Group x Sequence interaction, $F(2,36)=.33$, $p>.05$. It was concluded that practicing cup stacking in a distributed fashion will lead to better performance, however, reaction time gains can be elicited with either practice schedule after only one hour of practice.

Purpose

The purpose of this study was to examine the effectiveness of two different distributions of practice on cup stacking performance, using massed practice and distributed practice schedules. Considering the popularity of cup stacking, it would be beneficial to know which type of practice schedule enhances learning and performance the best.

Introduction

Cup Stacking is an individual or team activity where participants stack and un-stack specially designed plastic cups in pre-determined sequences while racing against the clock for the fastest time ("The competitive sport," n.d.). Speed Stacks Inc. claims that cup stacking promotes and increases hand-eye coordination, quickness, reaction time and ambidexterity ("Building team skills," n.d.). Although Speed Stacks, Inc. has made claims that the task will enhance motor skills, there is limited empirical evidence that can support their case. One study however, was conducted by Udermann et al. (2004) to investigate if cup stacking influenced hand-eye coordination and reaction time in second grade students. They found that cup stacking positively affected hand-eye coordination and reaction time in the participants rationalizing that it would also help students to become more proficient in motor skills, movement, and physical activities. Hart and Bixby (2005) found that both sides of the brain were active during cup stacking.

What is the most effective way to practice cup stacking? To date, no studies have been performed to examine various distributions of practice while cup stacking. Practice distribution has been investigated on its appropriateness to applied settings in a variety of contexts. To ensure optimal performance and learning in motor skills, researchers question as to whether massed or distributed practice is more beneficial (Lee & Genovese, 1989). Researchers also question the benefits of distribution of practice for the acquisition of motor skills in relation to the type of motor skill, such as discrete, continuous, or serial skills. Although there are no standards for the number or duration of practice sessions, general results indicate that distributed practice leads to better learning (Magill, 2004).

According to Lee and Genovese (1988) and Denny, Frisbey and Weaver (1955) distributed schedules lead to better learning than massed schedules for learning continuous motor skills. In contrast, Carron (1969) examined discrete skills and found that massed practice showed more improvement in learning than distributed practice. When examining serial skills such as cup stacking, limited research has been done.

Methods and Procedures

- **Thirty undergraduate students (ages 19-27yrs) volunteered to participate in this study and were randomly assigned to a practice schedule**
  - **Massed = 60 consecutive minutes**
  - **Distributed = 3 X 20 minute sessions**
  - **Control = no practice schedule assigned**
- **Practice groups watched video (*Speed Stacks Stacker Training DVD*) on cup stacking at the beginning of each session**
- **Participants performed timed progression stacking sequences (3, 3-3, 3-3-3, 6, 3-6-3) (Figure 1).**
- **Participants were measured for reaction time (RT) during pre and post trial sessions using the Johnson & Nelson (1986) reaction time test (as used by Udermann et al. (2004))**
- **Transfer test (6-6 stacking sequence) was conducted after completing 60 minutes of practice (Figure 2)**
- **Dependent variables included time to complete 6, 3-6-3, and 6-6 sequences and RT**
- **3 (group) X 2 (test) mixed ANOVA with alpha = .05 was used for reaction time statistical analysis.**
- **2 (group) x 3 (sequence) mixed ANOVA with alpha = .05 was used for stacking time statistical analysis.**

Figure 1. Display of different practice stacking sequences (Red Cups = 6 stack, Yellow Cups = 3-6-3 stack, Blue Cups = 3-3 stack).

Figure 2. Display of 6-6 stacking sequence used as the transfer test.

Results

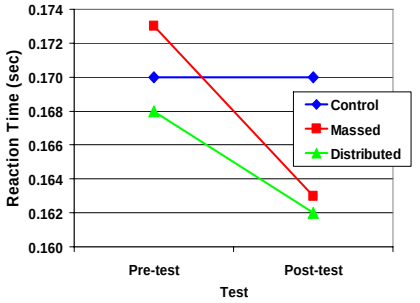

Figure 3. Reaction time means for each group before and after cup stacking practice.

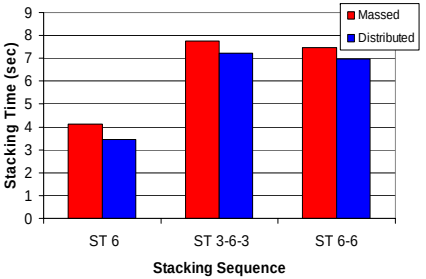

Figure 4. Stacking times for each group for each stacking sequence (ST 6-6 was used as the transfer test).

Discussion

According to the manufacturer of Speed Stacks, there are a number of positive benefits gained as a result performing cup-stacking. Speed Stacks Inc. claims that cup stacking promotes and increases hand-eye coordination, quickness, reaction time and ambidexterity ("Building team skills," n.d.). The reaction time results of this study showed that there was a significant improvement between pre and post tests for both the massed and distributed groups. Since there was not a significant change with the control group, this signifies that the results agreed with the claims made by Speed Stacks, in which practicing cup stacking can improve reaction time.

Stacking time results for the two distribution practice groups coincided with literature. Data illustrated that there was a significant difference between the two groups on cup stacking performance; the distributed group ended up with a faster stacking time for all cup stacking sequences as compared to the massed group. Cup stacking is a serial skill and according to Baddeley and Longman (1978) keeping practice sessions short and more frequent can lead to faster learning and better performance. Therefore, when cup stacking, a distributed practice schedule can lead to faster learning and better performance than continuous practice.

The significant improvement in reaction time with only 60 minutes of practice for both the massed and distributed groups supports the claims by Speed Stacks. Our study results support the findings of Undermann et al. (2004). Possible reasons for the distributed group having faster stacking times than the massed group could have been because the participants in the massed group may have resulted from massed group members becoming bored, frustrated, and/or losing focus on the task during the longer training session. Future studies will need to examine varies ratios of practice and rest to determine the most effective distributed practice schedule for this task, and to confirm these results with younger populations.

Results

Reaction Time Results (refer to Figure 3)

- **Significant Group (massed, distributed, control) x Test (pre, post) interaction was identified, $F(2,27)=8.910$, $p<.05$.**
- **LSD post hoc analyses revealed that only the massed and distributed groups improved their RTs following the 1-hour cup stacking practice.**
- **Significant differences between pre and post RT tests were found; both groups improved ($F(1,27)=23.691$, $p<.0005$).**
- **For the control group, no significant difference was found between the pre and post RT tests**
- **No significant RT difference between massed and distributed groups**

Stacking Time Results (refer to Figure 4)

- **Significant Group main effect ($F(1,18)=9.318$, $p<.05$)**
- **Faster stacking times exhibited for the distributed group**
- **No significant Group x Sequence interaction, $F(2,36)=.33$, $p>.05$.**
- **Distributed group was faster on all stacking sequences**

Conclusions

- **Distributed practice enhances performance and learning of the serial skills of cup stacking.**
- **Even 60 minutes of cup stacking practice can improve reaction time in young adults.**

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