

Comparing Alternate Mental Practice Methods for Learning a Novel Task

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Mental Practice (MP) Definition

- Using task repetition or rehearsal through motor imagery, which is cognitively producing a motor act without physically performing it, to ultimately improve motor performance.

(Doherty 1993, Gentili 2006, Malouin 2004, Decety 1999, Jackson 2001, Warner 1988, Bachman 1990, Eumyoung 2001, Mulder 2004)

Background

- MP of a motor task improves task performance over no practice at all.
(Gentili 2006, Jackson 2001, Feltz 1983, Fansler 1985, Nyberg 2006, Driskell 1994)
- MP is effective in novel task acquisition.
 - Effects both in early (Bohan 1999) & later skill learning (Feltz 1983).
- MP beneficial for motor & cognitive tasks (Gentili 2006).
 - More effective in discrete and serial tasks (Feltz 1983).
- MP causes cortical changes (Decety 1999, Nyberg 2006).

Purpose/Objective

- Two methods:
 - Audio-taped facilitation
(Fansler 1985, Bucher 1993, Page 2005, Fell 2001)
 - Live facilitation
(Gentili 2006, Malouin 2004, Bachman 1990, Bohan 1999, Maring 1990)
 - Both methods are effective
- Currently, no research comparing the two
- We want to compare the efficacy of the two methods to determine the superiority of one method over the other
 - Change in performance and retention

Study Rationale

- Advantages of audio-taped:
 - More cost-effective
 - More time efficient
 - May increase patient rehabilitative independence
- Determination of the more superior method may enhance future clinical decision-making.

Hypotheses

- Live facilitation will be statistically superior to audio-taped facilitation.
-Easier to attend to than audio.
- Both will experience improvements, thus the difference will not be clinically relevant.

Subject Inclusion/Exclusion Criteria

- Inclusion Criteria:
 - Healthy adults, age 18-50
- Exclusion Criteria:
 - Any prior experience with task (juggling with 2 or more items)
 - UE injury within past 6 months

Subject Demographics

- Convenience sample from UTC DPT students
- 28 total subjects: 22 females, 6 males aged 20-29 (mean 23.5 yrs)
- 25 right hand dominant, 3 left hand dominant
- All subjects signed informed consent

Materials and Apparatus

- Participant questionnaire
- Movement Imagery Questionnaire (MIQ)¹⁹
- Juggling Assessment Tool (JAT)
- Adherence questionnaire
- Juggling balls
- Intervention audio tapes
 - Control
 - Mental practice
- Audio cassette players with headphones
- Orientation video tape

JAT Reliability

- Intrarater: $\alpha = 0.926$
 - Cronbach's Alpha
- Interrater: $R = 0.89$
 - Intraclass correlation coefficient
- Good to High Reliability

Methods/Procedure

- Independent blinded assessor administered JAT
 - Pre-test
 - Post-test
 - Retention test
- Assessor practiced administering JAT prior to pre-test

Methods/Procedure

- Day 1:
- Participant eligibility screening
 - Informed Consent
 - Random group assignment
 - Pre-test using JAT
 - MIQ
 - Orientation video (5 min)
 - 10 min physical practice with feedback
 - Schedule future practice sessions

Methods/Procedure

- 2 Intervention Groups:
 - Live facilitation mental practice group (n=9)
 - Audio taped facilitation of mental practice group (n=7)
 - View introductory video and physically practice w/ feedback 1x/wk
 - Mental practice 3x/wk
- Control group (n=12)
 - View introductory video and physically practice w/ feedback 1x/wk
 - Relaxation via audio tape 3x/wk for 10 min each

Methods/Procedure

M	Tu	W	Th	F	S	Su
Day 1 with Pre-test	Video + PP	MP or C	MP or C			
MP or C	Video + PP	MP or C	MP or C			
MP or C	Video + PP	MP or C	Post-test			
	Retention Test					

* PP= physical practice; MP= mental practice; C= control group

Methods/Procedure

- Consistent number of juggling reps (30) for each mental practice group.
- Identical practice schedules among groups.
- Complete adherence questionnaire following each session.
- After 10 days, all subjects underwent a post-test using the JAT.
- 12 days after the post-test, retention test performed using the JAT.
- All data collected via JAT was blinded to group assignment.

Statistical Analysis SPSS

- Mixed Model Design
 - Interaction between 3 groups and 3 time intervals
- Kruskal-Wallis for nonparametric data
 - Gender
 - MIQ
 - Adherence
- General Linear Model for repeated measures, Oneway ANOVA, and Post Hoc Bonferroni for parametric data
 - JAT within groups
 - JAT among groups
- Retrospective Power Analysis using SAS
 - power > 0.99

Homogeneity

- No significant difference found for:
 - Gender ($p=0.58$)
 - MIQ ($p=0.42$)
 - Visual ($p=0.28$)
 - Kinesthetic ($p=0.75$)
 - JAT Scores at Pre-test ($p=0.260, 1.000, 0.510$)

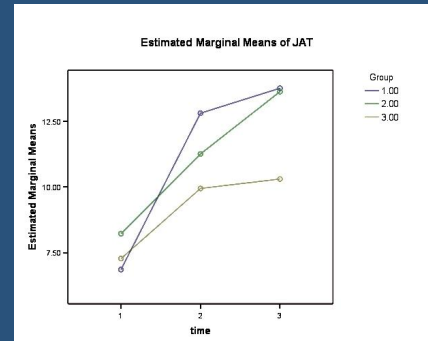
Statistical Analysis: JAT Scores

- Tests of Within-Subjects Effects
 - > Time
 - $F=120.38$
 - $p=0.000$
 - > Time*Group
 - $F=7.66$
 - $p=0.000$
- Tests of Between-Subjects Effects
 - > Group
 - $F=4.75$
 - $p=0.018$

One-Way ANOVA

	F	Significance
Pre-test	1.77	0.191
Post-test	4.06	0.030
Retention	9.27	0.001

JAT Score Improvement Over Time



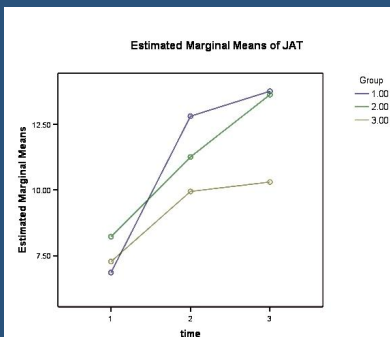
Differences Among Groups Bonferroni Post Hoc Test

	Group	Group	Significance
Post-test	Audio	Live	0.480
		Control	0.027
	Live	Audio	0.480
		Control	0.520
		Audio	0.027
Retention	Audio	Live	1.000
		Control	0.005
	Live	Audio	1.000
		Control	0.003
		Control	Audio
		Live	0.003

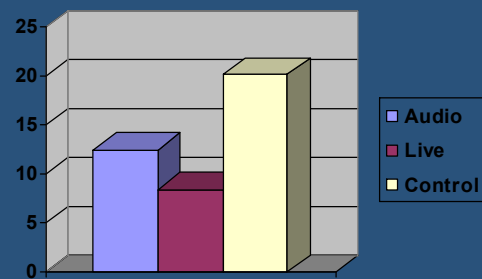
Discussion

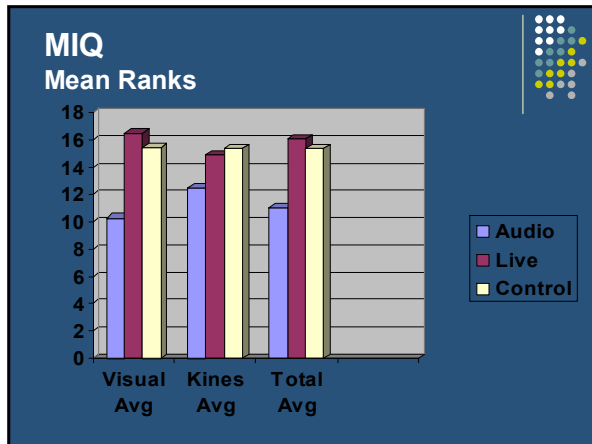
- Live vs. Audio
- Adherence
- MIQ

JAT Score Improvement Over Time



Adherence Average Mean Ranks





- ### Limitations
- Inadequate Adherence measure
 - Lack of completely controlled intervention environment
 - Poor generalizability
 - Unable to determine the participants' compliance to study design

- ### Conclusions
- Mental practice enhances motor learning.
 - Audio-taped facilitation is superior in improving immediate performance.
 - Live and Audio facilitation are equal for retention.
 - Further research is needed to determine whether the Live group would have improved more than the Audio group with a more remote retention test.

- ### Special Thanks
- Professor Tate
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Questions?

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