

# Music Experience Influences Laparoscopic Skills Performance

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## ABSTRACT

**Background:** Music education affects the mathematical and visuo-spatial skills of school-age children. Visuo-spatial abilities have a significant effect on laparoscopic suturing performance. We hypothesize that prior music experience influences the performance of laparoscopic suturing tasks.

**Methods:** Thirty novices observed a laparoscopic suturing task video. Each performed 3 timed suturing task trials. Demographics were recorded. A repeated measures linear mixed model was used to examine the effects of prior music experience on suturing task time.

**Results:** Twelve women and 18 men completed the tasks. When adjusted for video game experience, participants who currently played an instrument performed significantly faster than those who did not ( $P < 0.001$ ). The model showed a significant sex by instrument interaction. Men who had never played an instrument or were currently playing an instrument performed better than women in the same group ( $P = 0.002$  and  $P < 0.001$ ). There was no sex difference in the performance of participants who had played an instrument in the past ( $P = 0.29$ ).

**Conclusion:** This study attempted to investigate the effect of music experience on the laparoscopic suturing abilities of surgical novices. The visuo-spatial abilities used in laparoscopic suturing may be enhanced in those involved in playing an instrument.

**Key Words:** Laparoscopy, Skills training, Music, OSATS.

## INTRODUCTION

Laparoscopic intracorporeal suturing is an advanced skill that is not easy to learn. The visuo-spatial skills involved in successful task performance on simulators or in the operating room have been subject to some investigation.<sup>1-5</sup> Experience in playing video games is correlated with improved performance on skills simulators and in the operative environment.<sup>6-9</sup> Visuo-spatial and math skills have also been found to be influenced by music experience.<sup>10,11</sup> We investigated whether music experience correlated with laparoscopic suturing task performance in surgical novices.

## METHODS

### Study Design

Thirty novice first- and second-year medical students volunteered for the study. Sex, handedness, prior video game experience, and prior music experience were recorded for each participant. Video game and music experience were categorized as playing video games or an instrument: never (novice), in the past (intermediate), or currently (experienced). All participants were instructed by the same investigator (T. Boyd) in laparoscopic intracorporeal suturing using a teaching video without additional feedback. The study subjects were asked to perform 3 consecutive suturing task trials while being timed and videotaped for an objective structured assessment of technical skills (OSATS).<sup>12</sup>

### Metrics

Each task performance was timed in seconds. Attempts lasting longer than 600 seconds were stopped and recorded as 600 seconds. After the completion of the experiment, the videotaped task performances of each participant were graded by a group of experts, blinded to the identity or group assignment of the participant. A videotaped suturing task performance of a novice and an expert were used to "calibrate" the experts on a validated 5-point Likert-scale OSATS in each of 5 categories: respect for tissue, efficiency of time and motion, instrument handling, flow of task and forward planning, and knowledge of the specific task.<sup>12,13</sup> A score of 1 denoted an unskilled novice,

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Financial support was provided through a Dean's stipend for Tanner Boyd at the University of Texas Health Science Center San Antonio.

Presented at the 16th SLS Annual Meeting and Endo Expo 2007, San Francisco, California, USA, September 7, 2007.

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and a score of 5 described a skilled expert. Each videotaped performance was scored by 2 independent reviewers. The result for each category of each task trial was entered into a database.

**Data Analysis**

Because this study represents a subset analysis from a randomized trial, group assignment was taken into account as a variable in the statistical analysis. Mean suturing task time and mean OSATS scores were analyzed by using a repeated measures linear mixed model allowing for heterogeneity between the groups. Fisher’s exact test and the Student *t* test were used to compare group demographics. The Bonferroni method was used to adjust for multiple comparisons. The study was considered exempt by the Institutional Review Board.

**RESULTS**

All 30 students, 18 men and 12 women, completed the study. All participants were right handed. The majority of women had no video game but intermediate music experience. None of the women participants had extensive video game experience; only one had extensive music experience. Most men had both music and video game experience. There was no difference in the sex ( $P=0.13$ ) or music playing experience ( $P=0.54$ ) between the groups. The distribution of participants with video-game experience was significantly different between the groups. There were no experienced video gamers in group 1 and 12 (26.7%) in group 2 ( $P<0.001$ ).

Over the 3 trials, the number of novice participants able to

complete the task in less than 10 minutes increased from 6 subjects to 14 subjects. Men [mean (SD): 518.9 (115.4)] completed the tasks faster on average than women did [573.4 (63.0)];  $P<0.001$ . Students with extensive video game experience [mean=535.5 (SD=129)] performed the initial task trials faster on average than did students with limited or no video game experience [573.4 (57.1)], but this difference was not significant ( $P=0.26$ ). When adjusted for video game experience, those who currently played an instrument performed suturing significantly faster than subjects who did not [current: 536.4 (110.3), novice: 542.1 (104.2),  $P<0.001$ ]. The model showed a significant sex by instrument interaction ( $P<0.001$ ). Men who were musical novices or currently played a musical instrument sutured faster on the average than women in the same group did (**Table 1**). Time differences between men with intermediate or extensive music experience and male music novices were over 2 minutes, 135 and 137 seconds, respectively. Time differences between women with intermediate or extensive music experience and women music novices were significant at 12 to 13 seconds (**Table 1**).

The attention was then turned to the OSATS assessment. There was no difference by sex, video game, or music experience, or a group’s assignment in the OSATS results.

The scores for the individual task components (respect for tissue, time motion efficiency, instrument handling, flow of task, and apparent knowledge of task) were also assessed. Again, no statistically significant difference was found by sex, video game, or music experience or group.

**Table 1.**  
Average Task Time in Seconds Adjusted for Time Trend and Video Game Experience

	Music Experience			Novice-Intermediate	Intermediate-Experienced	Novice-Experienced
	Novice	Intermediate	Experienced			
Women*	567.6 (21.16)	555.4 (19.94)	554.3 (20.15)	12.2 (3.39)	1.1 (3.39)	13.3 (4.37)
P-value†				0.002	0.745	0.006
Men*	555 (19.97)	553.1 (19.96)	418.2 (20.12)	1.9 (2.52)	134.8 (3.61)	136.8 (3.61)
P-value†				0.45	<0.001	<0.001
Women-Men*	12.6 (3.62)	2.4 (2.18)	136.1 (4.36)			
P-value†	0.002	0.289	<0.001			

\*Mean (standard error).

†P-values should be compared with  $0.05/9=0.006$  to maintain 5% significance level (Bonferroni correction) due to multiple testing (9 comparisons).

## DISCUSSION

This relatively large laparoscopic task study included 30 inexperienced medical students with an interest in surgery, all of whom completed the study. This report summarizes a subgroup analysis from another study<sup>14</sup> and included a heterogeneous mix of participants in terms of video game and music experience randomized into 2 training regimens. Although we adjusted for video game and music experience and training regimen in our statistical analysis, the selection of the participants based on these variables may have added to the robustness of the analysis. We did not ask which instrument a participant played or had played in the past, nor did we assess proficiency in music or video game or music playing. We relied on the self-reported time frame of video game and music experience.

Our data are consistent with that in other studies regarding the effect of video game experience and laparoscopic task performance.<sup>6–8</sup> In addition, we hypothesized that prior music education improves the performance of laparoscopic intracorporeal suturing tasks. Music experience was found to be an independent factor for mean time to completion across all participants and was a significant factor among men and women separately. The most significant effect was seen among men, where current music experience improved the mean time to completion by more than 2 minutes compared with music novices. A similar pattern was seen among women, but the mean difference was small (13 seconds) and clinically negligible. Several years ago, Rauscher et al<sup>11</sup> reported improved mathematics skills in a group of school children undergoing concurrent piano instruction compared with a group of children with the same demographics and baseline performance but without piano instruction. Parsons described in 1998 that the cerebellum is activated while one played music, an area formerly thought to be mainly involved into fine motor movement. His group has since reported on findings in brain activation with amateur dancers, which also has a spatial component.<sup>15</sup> The brain location of music, speech, and motor capabilities is currently undergoing intense research due to relatively new functional imaging capabilities like PET scanning and functional MRIs and its possible promise in helping brain-injured patients or patients with Alzheimer's disease. The results seem to indicate that the functions are distributed widely across different brain regions. The question as to whether concurrent music education or exposure actually improves laparoscopic task performance would be an interesting topic of research in future studies.

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