The association between shoulder strength, hand dominance and boredom in a group of engineering students and faculty.

Methods

Subjects were recruited from a sports medicine class at The Cooper Union and included five undergraduate and engineering students and one faculty member (all male; age 25.3 ± 12.1 yrs; ht 1.79 ± 0.07 m; wt 75.8 ± 16.2 kg, mean ± standard deviation). Shoulder strength was assessed using a Lafayette Instruments manual muscle tester (MMT), with the arm in 90˚ abduction and the elbow straight in the "full-can" position. Strength was tested twice on each side (dominant, non-dominant) both before and after a dull but enlightening lecture in a sports medicine class. The average of the two measurements was used for pre- and post-lecture strength. Subjects indicated their level of boredom on a 35 mm visual analog scale (VAS), with the left end of the scale (0 mm) being "not at all bored" and the right end of the scale (35 mm) being "so bored you would like to kill yourself by swallowing your own tongue."

Repeated measures ANOVA (2 x 2) was used to assess the effects of hand dominance and the lecture on shoulder strength. Pearson product moment correlation was used to assess the association of boredom and strength loss (if any) following the lecture. A P-value of less than 0.05 was assumed to indicate statistical significance. All data are presented as mean ± standard deviation.

Results

	Dominant side	Non-dominant side
Pre-lecture	13.8 ± 4.4	13.0 ± 4.4
Post-lecture	13.3 ± 4.3	12.0 ± 3.7

Table 1: MMT-measured strength pre and post lecture. Strength reported in kg.

Strength measurements are shown in Table 1 above. Sitting through the lecture resulted in no loss in shoulder strength (effect of time, P = 0.369), with strength prior to the lecture averaging 13.4 ± 4.4 kg, and 12.6 ± 3.9 kg following. There was a small, non-significant (P = 0.119) difference in strength between sides, with dominant arm being approximately 9% stronger than the non-dominant arm (13.6 ± 4.2 kg vs 12.5 ± 3.9 kg, respectively), with no interaction noted between these two factors (P = 0.436, see Table 1; i.e., neither side gained nor lost strength differently than the other).

While there was no strength loss over time for the group as a whole, perhaps those who were more bored lost strength whereas those who were not did not (or vice versa: maybe those who were not bored wrote so many notes that their arms became tired). To check

this, we run a correlation. Strength loss was not correlated with VAS score for boredom on either side (dominant side: r = -0.116, P = 0.977; non-dominant side: r = 0.488, P = 0.427); see Figure 1.

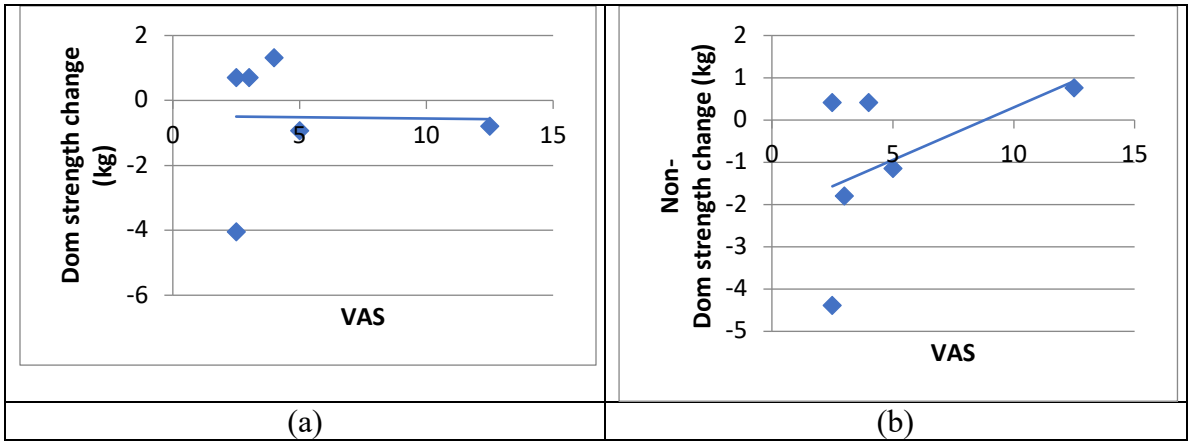

Figure 1: Correlation between strength loss and VAS boredom score for (a) dominant arm, (b) non-dominant arm. VAS plotted as mm. See text for details.

Weaknesses in Study Design

There was no control for pre-lecture activity; physical activity could have been a contributing factor, as could nutritional status. Moment arm about the shoulder was not measured for the testing, but merely eyeballed by the investigator, as was positioning of the handheld dynamometer. This was a very small sample size, so some differences may have been missed (the side-side difference in strength could be interesting, given more subjects), and one subject's demographics were quite different from the rest of the group.

Let's Go Fishing; This Is Not Designed to Look for Sex Differences, But Let's Try Anyway

This is more along the lines of a retrospective, hey-we-have-some-data-let's-get-another-publication study. It is well-known that men are stronger than women; conversely, women experience less fatigue than men. Does this hold for a sub-population of society-at-large, i.e., engineering students? Our dataset, unfortunately, did not include data from both sexes. So to do this, we have to look at some past data...

In this case, we tested 15 male (age 20.5 ± 0.8 yrs; ht 1.78 ± 0.08 m; wt 77.0 ± 7.4 kg) and 5 female (age 20.6 ± 0.2 yrs; ht 1.66 ± 0.08 m; wt 50.2 ± 6.5 kg) engineering students. However, strength, will be very related (i.e., correlated) to size; thus it would be useful to examine a measure of strength normalized to body weight. Also, any loss in

strength will be related to initial strength (the stronger one is, the more strength one will lose). Thus, strength loss should be normalized to initial strength. Independent t-tests were used to compare differences in strength (dominant, pre-lecture) and strength loss between sexes.

Results

	Male	Female	P [independent t-test]
Strength	13.9 ± 4.3 kg	5.7 ± 3.4 kg	0.001
Strength, normalized	18.0 ± 5.0 % body wt	11.1 ± 1.6 % body wt	0.008
Str change	-0.2 ± 2.3 kg	0.7 ± 1.3 kg	0.386
Str change pct original	-6.6 ± 24.4 %	11.5 ± 30.1 %	0.198

Non-dom strength is not shown, but results are similar. Also, everybody was similarly bored regardless of sex (P = 0.416; data not shown).

This is a trivial example, and one where we would expect to find a particular result. *However*, if we were really uncertain as to what our findings might have been, what would the correct approach be? This is the nature of research.