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A Proof of Concept Study on Cortisol Response to Three Different Educational Environs (Alone, Same-Sex, and Mixed-Sex)

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This proof of concept study assessed student cortisol levels under three environs: 1) alone; 2) same-sex setting; and 3) mixed-sex setting after completing a cognitive task. The results indicated that both males and females demonstrated increased levels in the same-sex environs compared to the other environs. The relevant issue for educators is whether this response is adaptive. Implications of these findings are discussed.

Keywords: Mixed-Sex Setting; Higher Education; Proof of Concept

Introduction

The primary aim of this research was to conduct a "Proof of Concept" study (POC). POC is a process that attempts to achieve supporting evidence for the supposition, or concept under consideration. The concept for this study addressed the elevated cortisol levels of women performing in mixed-sex environs. Fecund research studies support the inhibiting performance of women in the presence of men (Niederle & Vesterlund, 2010). These studies often conclude with proposing separate sex higher education environments (Burton, 2010). Studies such as Hargittai and Shafer (2006), noted the effects of mixed-sex settings range from women failing to perform well in competitions, to women shying away from environments in which they have to compete.

Corston and Colman (1996) report that adult women conducting a computer-based task performed poorer in the presence of men even after controlling, 1) levels of computer usage; 2) computer-related anxiety; 3) confidence and competence with computers; and 4) attitudes toward computers and computer users. Other researchers postulate that women may be less effective than men in competitive environments, even if they are able to perform similarly in non-competitive environments (Hargittai & Shafer, 2006). To assess this attenuation, Hargittai et al. (2006) increased the competitiveness of the environment in a laboratory experiment, which significantly increased the performance for men, but not for women. This effect is stronger when women have to compete against men than in single-sex competitive environs.

Invoking the Integrated Model (IM) (Tooby & Cosmides, 1992) may help to explain the differential performances of subjects in mixed-sex settings. The IM posits that humans are born with physiological responses to specific stimuli including mixed sex educational environs (Giamia, Ohlrichsb, Quilliamc, & Wellingsd, 2006). One hypnotized physiological process elates to cortisol levels. Cortisol was chosen as an indicator because it responds to a wide range of physiological, behavioral and cognitive functions and thus would serve as a reliable indicator of physiological change.

If the sex of the partner is a significant stimulus to elicit a physiological response, cortisol should be greater in the mixed-sex setting than in same-sex and the alone settings. If, however, there are no differences, researchers cannot empirically conclude that the mixed-sex settings influenced the tasks under investigations for the individual. In this POC study, the hypothesis was that women would demonstrate a significantly greater level of cortisol compared to men in the mixed-sex educational setting.

Participants

The sample for this POC study was comprised of nine participants (5 males and 4 females) from a comprehensive doctoral university in the Southeastern United States. Participants were included if they met the following criteria, enrolled in good standing at the university, maintained a B (3.0) grade-point average, obtained junior status, and declared an academic major. This study was approved by the institution's IRB. All selected students signed a consent form that explained the purpose of the study and asked for their permission to use their data. All participants were given a copy of the completed manuscript prior to submission to review and confirm the integrity of the results.

Procedure

All students completed a cognitive task under three environs in the following sequence: 1) alone; 2) same-sex setting; and 3) mixed-sex setting. A base line sample was also taken prior to the study. Saliva samples were extracted from the students after experiencing each of the environs. ELISA kits were employed to assess the cortisol levels in the saliva samples.

Table 1.
The Means, SEM, and CI95 for Cortisol Levels at each Environs.

Time	Mean	Std. Error	95% confidence interval	
			Lower bound	Upper bound
Base	.877	.058	.740	1.014
Alone	.877	.047	.767	.988
Same	1.099	.045	.993	1.204
Mixed	1.024	.061	.881	1.167

Results

A 2 (gender) × 4 (environs: alone, same-sex and mixed-sex) between/within ANOVA was conducted with cortisol level as the dependent variable. Statistical significance was set with alpha of $p < 0.10$ to enhance power as recommended by Stevens (2002). Results indicated no statistically significant gender effect or interaction effect. However, there was a statistically significant environs effect, $F(2, 5) = 4.71$, $p = .012$, Eta-Squared = .37 (a large effect). Pairwise comparisons using the LSD technique reported that regardless of gender, participants' cortisol levels in the mixed-sex setting were statistically significantly greater than in the alone or same-sex environs. There were no statistically significant differences between the alone and the same-sex environs. Descriptive statistics are presented in **Table 1**.

Discussion

Although the results of this POC study provide initial physiological evidence that cortisol responds to a wide range of physiological, behavioral and cognitive functions and did serve as a reliable indicator of physiological change, the hypothesis that women would demonstrate greater levels was not supported. The results indicated that both males and females demonstrated increased levels in the same-sex environs compared to the other environs. The relevant issue for educators is whether this response is adaptive or not. Perhaps this increase cortisol may heighten the arousal level of the subject which could then either enhance or attenuate performance. Findings such as these may have beneficial social and educational implications. The more we discover about how stress-related HPA axis responses impact sexually dimorphic brain cognitive mechanisms, the better chance we have to create optimal learning environments.

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