

# The Effect of Gender on Anxiety and Competitive Drive

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## Acknowledgements

Ms. Allison Blunt who acted as my mentor through research, designing, and conducting my study.

Mr. Michael Ciavarella for his assistance in helping me form appropriate calculus question sets and for allowing me to use his students.

Mr. Randy Gunnell for acting as my research teacher and providing me guidance through my process.

Mr. Louis Kail for allowing me to use his students and classtime during PE classes to conduct my experiment.

## Abstract

In academic competition, specifically mathematics, there are clear differences in the anxiety levels as well as the competitive drive or performance levels of males and females. Understanding the connection between gender, anxiety, and competitive drive can aid the development of a deeper understanding of the competitive dynamic of males and females within academics. This experiment tested differences in anxiety and competitive drive between the sexes by asking high school juniors enrolled in AP calculus BC to take the State-Trait Anxiety Inventory (STAI) to evaluate their level of anxiety before and after completing three problem sets in three different types of competitive scenarios: by themselves, in same sex competition, and in coed competition. Additionally, the experiment aimed to determine if there was a link between gender, anxiety level, and performance level, which indicated competitive drive, by comparing the individual results of each participant throughout the rounds, and cross comparing these performance levels to their self reported anxiety levels throughout the rounds. It was determined that females experienced a significantly higher level of anxiety than males in individual competition, homogeneous competition, and coed competition. Additionally, females performed significantly worse in coed rounds of competition compared to same sex competition. In academic competition for males, males' performance was significantly better in the same sex round compared to the individual round. Furthermore, males performed significantly better in the coed competition round compared to individual competition. Understanding the differences in the anxiety and performance levels between the sexes in various types of competitive academic environments could help explain differences in the male to female ratio in many STEM professions or classes.

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## Introduction

Anxiety can be defined as a general feeling of uneasiness or worry regarding a situation. Competitive drive can be defined as the desire to win in a competition. Hammond et al (2013) found a direct link between performance in sports and anxiety levels. This phenomenon, while present in males, seems to be more pronounced in females (Kar, 2013). Girls drop out of high school sports at a rate of 6 times more than boys (momsTeam). A possible explanation could be that girls experience higher levels of competition anxiety than males, even while participating in the same sport (Krane *et al.*, 1994).

There has been much investigation into the differences in anxiety and performance levels among boys and girls while competing. A study conducted by Gneezy *et al.* (2004) found competition was beneficial to race times of boys while harmful to race times of girls (Gneezy et al., 2004). A possible explanation they proposed was evolutionarily; male animals around the approximate age of puberty begin to compete to find a mate. Female animals do not feel a need to compete as they are commonly the ones being sought after. This may explain Gneezy's results because as humans approached the age of puberty, there could have been a shift in the competitive drive of males and females.

There has also been reported differences in anxiety levels felt during competition among males and females. Kar (2013) examined the anxiety levels of male and female collegiate track athletes. The study found that across all events females experienced a higher average level of anxiety. Additionally, an experiment was conducted to compare the pre-competitive anxiety felt by males and females in both individual and team sports. This study found, overall, females experienced higher levels of anxiety. It can be concluded from these two studies that even when competing in the same type of competition, females on average feel a higher level of anxiety compared to their male counterparts. Furthermore, Gneezy *et al.* (2004) found that girls and boys performed differently in competitions. In this experiment, girls and boys ran a race individually, then against other children of the same sex, and finally against children of the opposite sex. They found that when girls competed against girls, their times worsened compared to their initial individual times, while boy's times while competing against other boys on average increased compared to their individual times. Furthermore, it was found that as girls competed against boys with similar times, they had worse times than their individual initial run. In fact, in the co-ed races where the girl had a faster individual time than the boy, 73% of the time the boy won. Kar (2013) found that girls had more anxiety than boys in competition and Gneezy *et al.* (2004) found that girls performed poorly in competition especially against boys. However, few known studies have proposed anxiety as the reason for girls' decrease in performance.

Anxiety and varying performance levels experienced during competition is not exclusive to athletic competition, but is prevalent throughout academic competition as well. Devine *et al.* (2012) found that females reported feeling higher levels of mathematical anxiety compared to males when presented with the same math questions. Furthermore, Cotton *et al.* (2013) investigated the difference in performance levels of males and females in a single round of mathematical competition compared to multiple rounds. This experiment found that although males outperformed females in the first round, females outperformed males in the remaining rounds. Seemingly, in the initial round of competition, males overperformed while females underperformed, having no connection to their true mathematical abilities. These findings suggest, at least initially, competition in academics negatively impacts the performance of females while benefits the performance of males.

#### *Gap in Knowledge*

Although the differences in anxiety levels as well as the differences in competitive drive among females and males has been heavily researched, there has yet to be an exploration into the connection between the two. The conclusions that girls experience more anxiety pre-competition and while competing, in addition to the fact that girls seem to experience a lower competitive drive while competing, suggests these two phenomena may be connected.

#### *Purpose of Experiment*

The purpose of the study was to determine if anxiety among female and male high school students differed in coed or homogeneous competition when compared to individual competition, and whether anxiety levels affected the performance levels. The question posed was does anxiety among female and male high school students differ in coed or homogeneous competition and does this anxiety lead to decreased performance levels? The hypothesis formulated was girls will experience more anxiety and decreased performance compared to boys while competing, compared to individual competitions. The experiment was conducted in two parts: first anxiety levels and performance were compared between high school aged boys and girls in an athletic competition; then, anxiety levels and performance were compared between high school aged boys and girls in an academic competition. The results of this study will provide new insights into how competitive drive and anxiety are linked, and how these factors vary with different types of competition.

## Methodology

### **Part 1 and 2 Institutional Review Board (IRB) Approval**

IRB approval was received from the high school prior to beginning the experiments.

## **Part 1: The Relationship Between Gender, Anxiety, and Performance in Athletic Competition**

### **Recruitment of Participants**

20 subjects, composed of 9 females and 11 males participated in the study. The subjects were all volunteers, informed of the experiment through an announcement in their physical education period, ranging from 14-18 years old. The athletic experience of the subjects ranged, with 6/9 of the females and 9/11 of the males reporting they currently played competitive sports. The subjects were arbitrarily assigned numbers as a method of identification to maintain anonymity. This number was preserved throughout the duration of the experiment as a form of identification of responses and times.

### **Self-Reported Anxiety**

Prior to each round, the subjects were asked to self-report their anxiety using an adapted form of the STAI, a measurement tool used to gauge a person's anxiety at a moment. Participants were asked to rate their concern about the pending competition on a scale of 1 through 4; 1 being they were not anxious at all and 4 meaning they were very anxious. Additionally, subjects were asked to describe their involvement in athletics as responses might differ for experienced athletes. After each round, participants were asked to rate their anxiety levels again using the same scale. In addition, participants were asked to explain in their own words the feelings they had during the competition once they had finished. The after competition report was compared to the pre-competition report to determine the change in anxiety throughout each round of competition.

### **Rounds of Competition**

The experiment, which spanned the course of 14 days, was conducted every day at 8:30 am during physical education classes. As the experiment was limited to the schedule of the high school, the period for experimentation every day was 40 minutes, the length of one period. To limit outside interference or factors that may impact the anxiety experience or results, the experiment was conducted on the side of normal class activities. The experiment consisted of three rounds of competitions where participants were timed as they raced across the width of a basketball court (47 feet).

As seen in Figure 1, each participant completed the self-reported anxiety questionnaire and then ran an individual race with no competition. The time to complete the race was recorded. Following this

race, the subjects completed the post race section of the questionnaire. In the second round, subjects of the same gender (homogeneous competition) with similar individual race times competed against each other in the race. The time to complete the race was recorded. The same pre-and post- test was administered to assess anxiety levels. Additionally, participants reported any differences in anxiety or emotion compared to their individual race. In the third round, subjects of opposite genders with similar individual and homogeneous times competed against each other in the race. The time to complete the race was recorded. The same pre- and post- test was administered to assess anxiety levels of the participants.

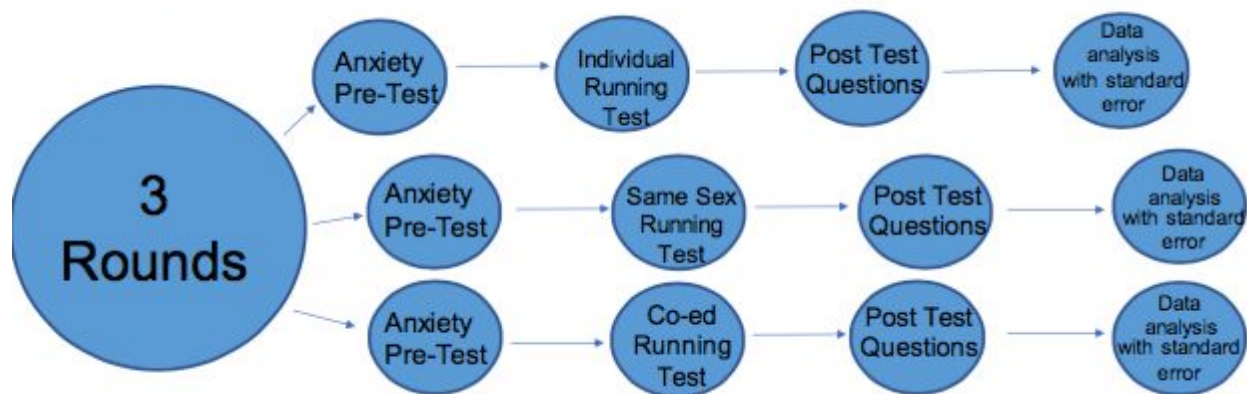


Figure 1: Experimental Protocol

## Part 2: The Relationship Between Gender, Anxiety, and Performance in Academic Competition

### Recruitment of Participants:

14 subjects, composed of 6 males and 8 females, were recruited in the academic experiment. The subjects were all volunteers and all were in their junior year of high school and enrolled in the Advanced Placement BC Calculus Class. This reduced the possibility of one participant having an obvious mathematical advantage over another, as all members of this class took the same entry level classes and consciously choose to take this specific course despite less challenging options offered. As the subjects were all members of the junior class, their ages ranged from 15-16 years old. The subjects again were arbitrarily assigned numbers as a method of identification to maintain anonymity. This number was preserved throughout the duration of the experiment as a form of identification of responses and scores.

### Self Reported Anxiety

Similar to the athletic competition, the participants were asked to self-report their anxiety using an adapted form of the STAI, a measurement tool used to gauge a person's anxiety at a moment, prior to each round. Participants were asked to rate their concern about the pending competition on a scale of 1 through 4; 1 being they were not anxious at all and 4 meaning they were very anxious. Additionally, subjects were asked to explain their motivation behind taking Advanced Placement BC Calculus. After each round, participants were asked to rate their anxiety levels again using the same scale as in the pre-test. In addition, participants were asked to explain in their own words the feelings they had during the competition once they had finished. The post-competition report was compared to the pre-competition report to determine the change in anxiety throughout each round of competition.

### **Rounds of Competition**

The experiment, which spanned the course of 20 days, was conducted sporadically, as the rounds had could not interfere with class times and therefore were accommodated to fit to the subject's schedules. To limit outside interference or factors that may impact the anxiety experience or results, the experiment was conducted in an isolated sector of the school library every period of experimentation. The experiment consisted of three rounds of competitions where participants were challenged to complete a series of 3 calculus questions within a given time.

The participants will undergo the same experimental protocol from part 1, as described in Fig 1. In place of an individual running race, the participants will complete the set of 3 calculus questions from the unit "the formal definition of the derivative".

### **Parts 1 and 2 Data Analysis**

Data was analyzed for both performance results and self-reported anxiety levels. In both cases, participants scores were compared before and after competition in each round as well as between rounds; and average responses of males and females were compared throughout the three rounds. T-Tests were used to determine significance.

## **Results**

### **Part 1**

The main results from this study found females reported feeling very anxious throughout every round of athletic competition significantly more than males ( $p=.02$ ). Furthermore, Fig 2 shows no male subjects reported feeling very anxious in homogenous competition, compared to 33% of females reporting feeling very anxious in this round and 33% reporting feeling moderately anxious.



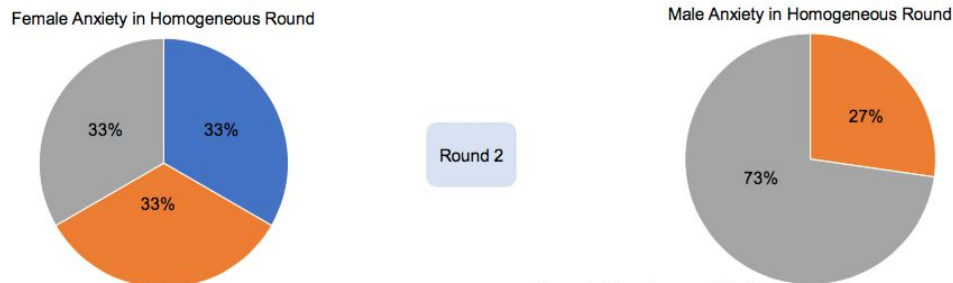


Figure 2: Average responses from self reported anxiety measurement in same sex round; blue represents feeling very anxious, orange represents feeling moderately anxious, and gray represents feeling at ease

In addition, Fig 3 highlights males reported feeling at ease in co-ed competition significantly more than females ( $p=.0003$ ), who conversely reported feeling very anxious significantly more than males ( $p=.03$ ) within this same round.

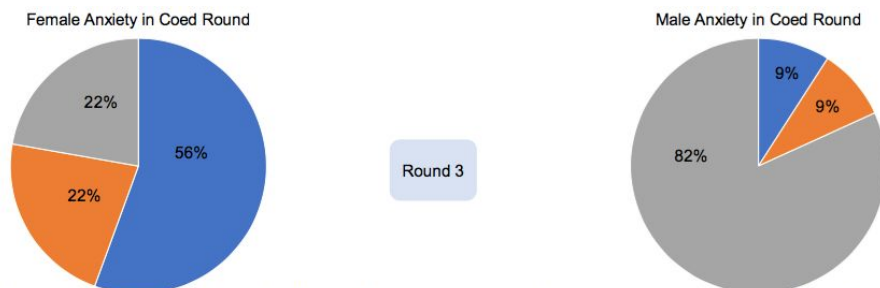


Figure 3: Average responses from self reported anxiety measurement in same sex round

Females reported feeling embarrassed to compete significantly more than males ( $p<.05$ ), while males stated they felt they competed at a higher level as the rounds progressed, providing reasoning such as, “I wanted to win”, significantly more than females ( $p<.05$ ). These findings not only support the hypothesis, but supplement the findings from previous studies, such as Gneezy et al (2004), which found

females have higher levels of anxiety than males even within the same competition. Despite this significance, the relationship between gender, competition, and performance level was not found to be significant.

Looking at the performance times of males and females throughout the three rounds, the average time of females in the homogenous race was the fastest, indicating an increased competitive drive in same sex competition (Figure 4). However, this trend does not continue as the time during the co-ed race increases, suggesting a decreased competitive drive in co-ed competition.

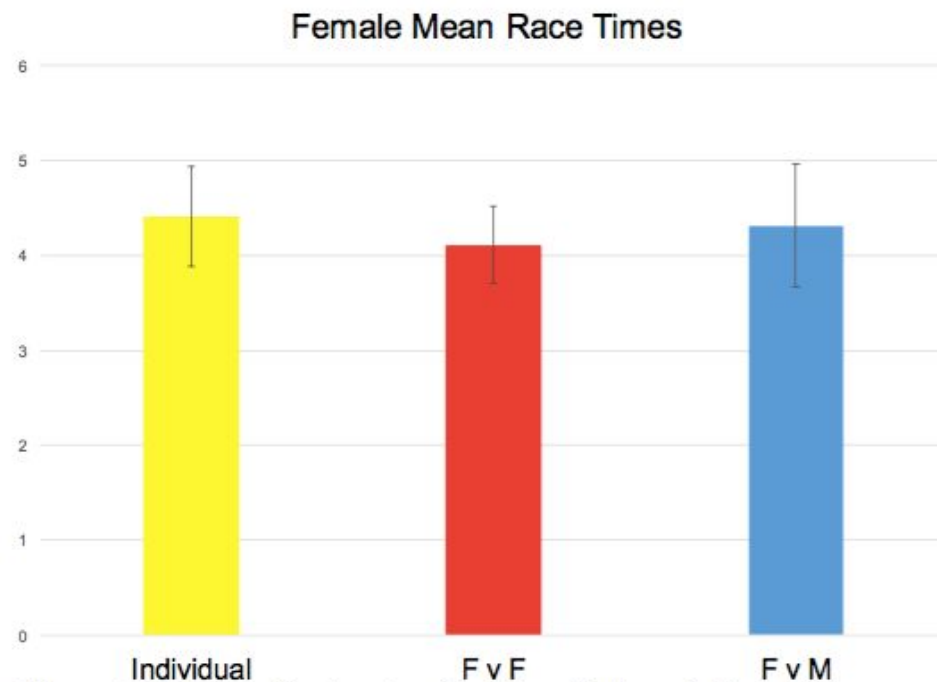


Figure 4: Mean performance time throughout females in each round

Additionally, the time of the male subjects decreased on average throughout the different rounds. The male subjects generally became faster during the homogenous competition as well as the co-ed competition, implying an increase in competitive drive in both cases (Figure 5).

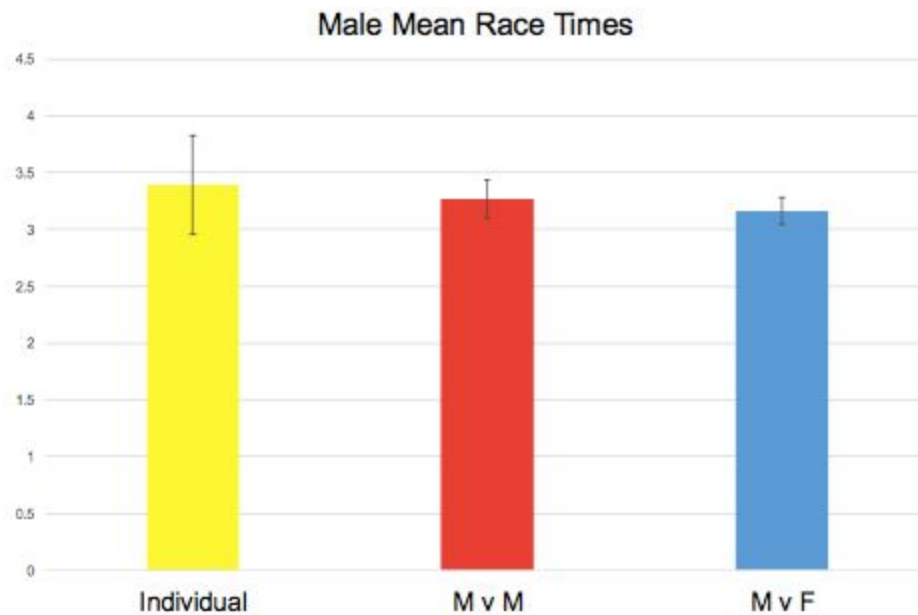


Figure 5: Mean performance time throughout males in each round

## Part 2

Similar to athletic competition, females in academic competition reported feeling significantly higher levels of anxiety in all three rounds ( $p < .05$ ). Additionally, males reported positive phrases, such as “I tried harder against someone” and “I felt good getting the answers right”, significantly more than females ( $p < .05$ ).

Unlike the athletic competition, Fig 6 shows the significance of the relationship between competition, performance level, and gender in academic competition. Females performed significantly worse in coed rounds of competition compared to same sex competition ( $p = .04$ ). In academic competition for males, males performance was significantly better in the same sex round compared to the individual round ( $p = .04$ ). Additionally, males performed significantly better in the coed competition round compared to individual competition ( $p = .002$ ).

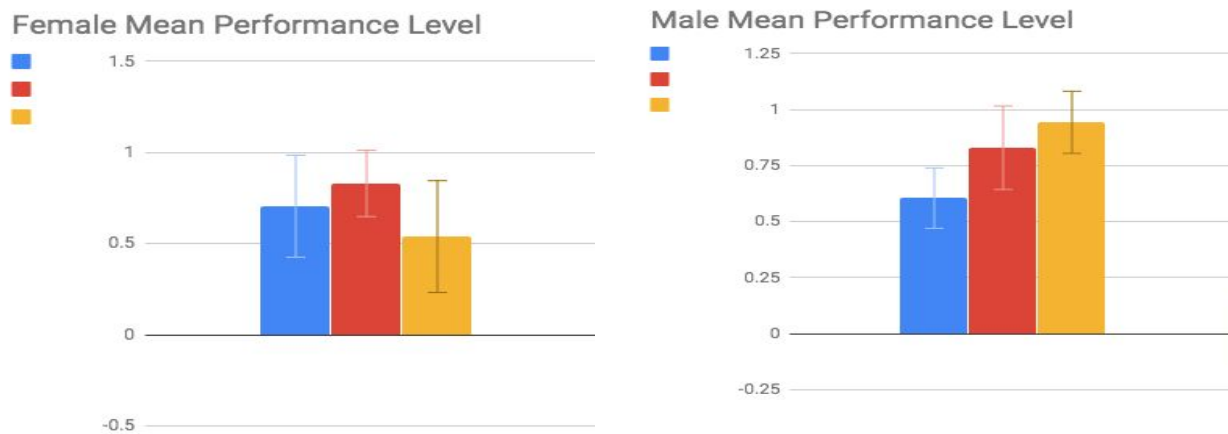


Figure 6: Mean performance results of females and males throughout 3 rounds; blue represents the individual competition, red represents same sex, and orange represents coed

## Discussion

### **Part 1**

The hypothesis is partially supported by these results. Although the relationship between gender, competition, and performance level was not significant in athletic competition, there is still an increase in time taken during the co-ed competition when compared to the individual run of female subjects, suggesting a decrease in competitive drive while competing against the opposite gender. Considering the male subjects of the experiment, the average times for males lowered in each competition. This finding agrees with the results found by Gneezy et al that competition benefits the performance of boys (Gneezy et al, 2004). This trend was not the same for the girls. When competing against the same gender, the girls time on average decreased, suggesting a higher level of competitive drive. On the other hand, when girls competed in co-ed competition, their times on average increased, indicating a lower level of competitive drive. This discovery is interesting as it may be connected to the possible explanation offered by Gneezy et al regarding evolutionary differences in males and females leading to differences in competition levels (Gneezy et al, 2004). Despite the lack of significance found between gender, competition, and performance level, the hypothesis's assertion regarding gender and anxiety was supported. After the responses from the questionnaire were analyzed using a T-test, it was established females reported feeling very anxious significantly more than their male counterparts, even within the same competitive round. These conclusions coincide with those of previous studies, such as Kar in 2013, that found girls competing in the same event as boys experience higher levels of anxiety (Kar, 2013). As girls experienced more anxiety while simultaneously experiencing a decrease in competitive drive, the gap in

the existing knowledge was addressed, suggesting there is a link between the anxiety girls feel in competition and their decrease in competitive drive. Despite this, the connection is not totally significant, as the relationship between gender and performance times was  $p > .05$ . This lack of significance could be caused in part by the limitations of the athletic experiment. One important limitation to consider was demand characteristics. As subjects knew the objective of the experiment, they may have acted or responded in a certain way in hopes of providing favorable responses. Additionally, as this experiment was limited to the confines of a high school, the sample size was relatively small and only included ages 14-17, and therefore may not be totally representative of a larger group. Lastly, 6/9 females and 9/11 males reported competing in athletic sports, possibly impacting the relationship between anxiety and performance level, as they are used to performing a certain way even with high levels of anxiety. Although these limitations do not take away from the findings of the experiment, they are still important to consider.

## **Part 2**

The hypothesis was supported by the results. Unlike part 1 of the experiment, the results assessing the relationship between gender, competition, and performance level was found to be significant ( $p < .05$ ). Males performed significantly better in both same sex and coed competition when compared to individual competition, compared to females who performed significantly worse in coed competition compared to individual competition. This significance supports previous findings, such as Cotten *et al* (2013), which found males outperformed females in initial rounds of mathematical competition, even when they had equal or less ability than their female counterparts. Similar to part 1 of the experiment, females experienced a significantly higher level of anxiety in all rounds of competition than their male counterparts ( $p < .05$ ). This significance was determined through analysis of the self-responses on the adapted version of the STAI, as well as the analysis of the free response questions. These findings not only support the hypothesis and align with the findings regarding gender, competition, and anxiety of part 1, but supplement previous conclusions, such as ones of Devine *et al* (2012), which state females report feeling higher levels of mathematical anxiety than males even when faced with the same content. These findings are important as they support the initial hypothesis while simultaneously supporting conclusions from previous experiments.

## **Implications**

The findings of these studies are important as they reveal more information about the varying effects of competition on males and females, while simultaneously supporting findings from previous studies. As females reported feeling significantly more levels of anxiety than their male counterparts in

the same rounds of athletic competition, it can be determined a fundamental difference in the emotional state of males and females during different types of competition. This is considerable as there is a vast difference in the number of females in competitive, high ranking positions compared to males. This is empirically shown as only 5% of CEOs in Fortune 500 companies are female. This difference is not caused by difference in qualifications, as shown by my second experiment. The female and male subjects in my experiment regarding academic competition were equally as qualified mathematically, as they all took the same entry level class and had the same teacher. This fact is supplemented by the fact that in the legal sphere, 45% of associates are women, however only 19% are equity partners. As a result, the differences in anxiety felt may be a cause for this uneven ratio. Furthermore, the findings from this experiment are important as they spark social reflection on the root of these differences. As suggested in Hibbard et al's experiment (2010), these differences may be caused by societal stereotypes or expectations regarding males and females, such as associating competitiveness with masculinity, inclining females to feel ashamed of their competitive drive and hindering their performance. The differences in recorded anxiety found in both athletic and academic competition in high school students fuel reflection on the cause, and can possibly lead to social change in the future.

## References

- De Lench, B. (n.d.). Sports dropout rate for girls six times rate for boys. In *MomsTeam*. Retrieved December 20, 2018, from <https://www.momsteam.com/successful-parenting/youth-sports-parenting-basics/parenting-girls/sports-dropout-rate-for-girls-six>
- Devine, A., Fawcett, K., Szűcs, D. *et al.* Gender differences in mathematics anxiety and the relation to mathematics performance while controlling for test anxiety. *Behav Brain Funct* **8**, 33 (2012) doi:10.1186/1744-9081-8-33
- Gneezy, U., & Rustichini, A. (2004, May). *Gender and competition at a young age*. Retrieved from <http://rady.ucsd.edu/faculty/directory/gneezy/pub/docs/gender.pdf>
- Hammond, T., Gialloreti, C., Kubas, H., & Davis Hap, H. (2013, July). *The prevalence of failure-based depression among elite athletes*. Retrieved from Clin J Sport Med website: <https://www.ncbi.nlm.nih.gov/pubmed/23528842>
- Hibbard, D. R., & Buhrmester, D. (2010). Competitiveness, gender, and adjustment among adolescents. *Sex Roles*. <https://doi.org/10.1007/s11199-010-9809-z>
- Hussain, F., Zaman, A., & Idris, M. (2014, September). *Pre-competitive anxiety linked with gender difference in collegiate athletes of khyber pak* (Research Report No. ISSN: 2090-4274). Retrieved from [https://www.textroad.com/pdf/JAEBS/J.%20Appl.%20Environ.%20Biol.%20Sci.,%204\(9S\)82-93,%202014.pdf](https://www.textroad.com/pdf/JAEBS/J.%20Appl.%20Environ.%20Biol.%20Sci.,%204(9S)82-93,%202014.pdf)

- Kar, S. (2013). Measurement of competition level anxiety of college level athletes by using SCAT. *International Journal of Engineering Science and Innovative Technology*, 2(3), 367-375. Retrieved from <https://pdfs.semanticscholar.org/3960/8ee3982d1781683affdbb2d57728623525ed.pdf>
- Krane, V., & Williams, J. M. (1992, July). *Cognitive anxiety, somatic anxiety, and confidence in track and field athletes: The impact of gender, competitive level and task characteristics*. Retrieved from [https://drive.google.com/file/d/0B4cQZM\\_WCqL4dkprZ1N5X3YwS2NpYWR5blBYUVVDM0R1TlBN/view](https://drive.google.com/file/d/0B4cQZM_WCqL4dkprZ1N5X3YwS2NpYWR5blBYUVVDM0R1TlBN/view)
- Mendick, H. (2006). *Masculinities in mathematics* (D. Epstein & M. Ghail, Eds.). Maidenhead, Berkshire, England: Open University Press.
- Warner, J., Ellmann, N., & Boesch, D. (2018, November 20). The Women's Leadership Gap. Retrieved November 11, 2019, from Center for American Progress website: <https://www.americanprogress.org/issues/women/reports/2018/11/20/461273/womens-leadership-gap-2/>