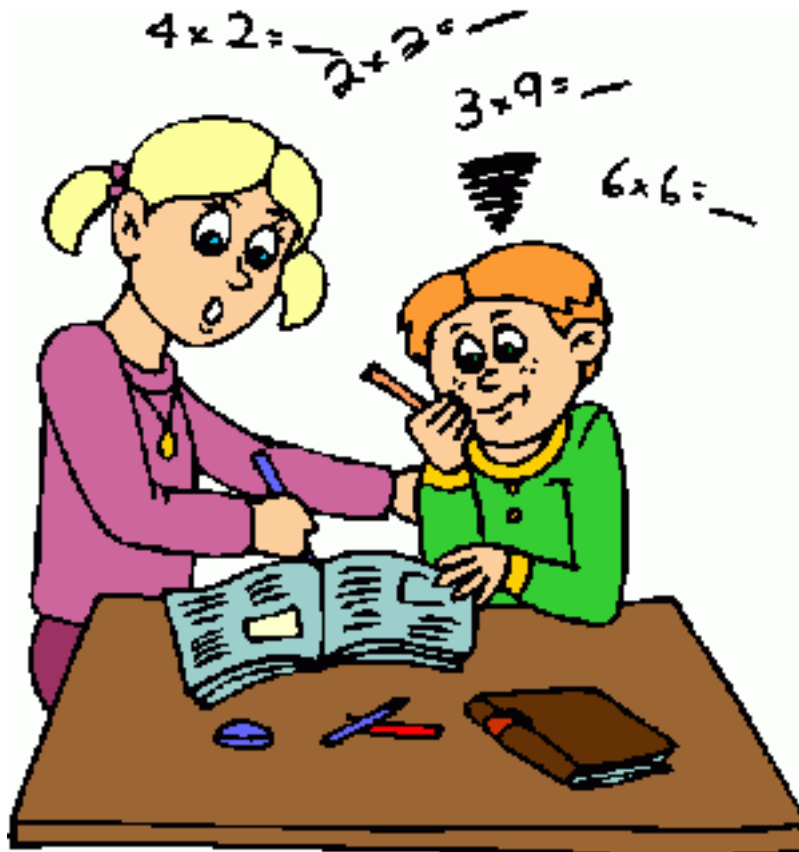


# Males Are Better At Math Than Females



## Executive Report 2011

# Our Team

Three students investigated this proposition.



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# Methods

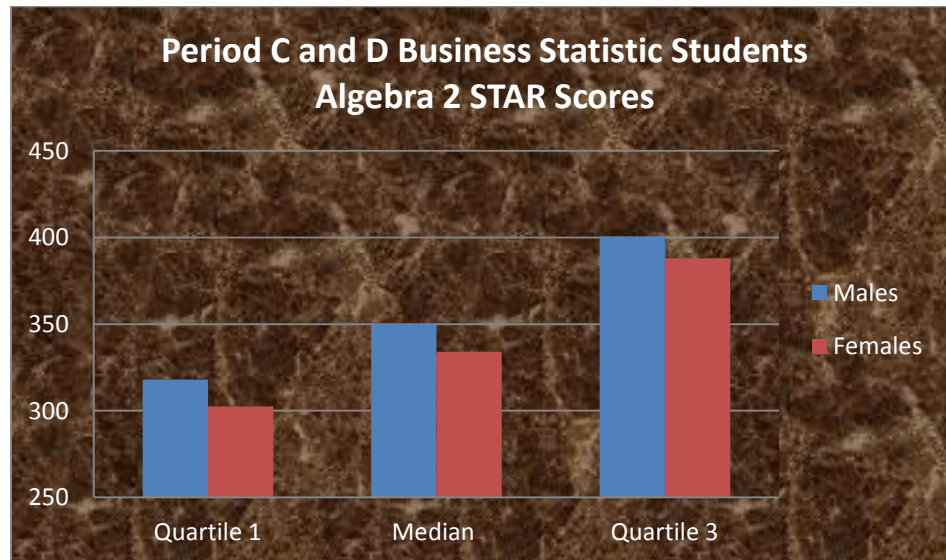
The data was gathered in a student survey administered to all Business Statistics students in the first week of the fall semester. Students completed the surveys at home, and were given assignment credit for their participation. No student was marked down for not answering individual questions. Our team used Excel's single variable data analysis functions and graphic displays to examine the data for patterns and relationships that would be most relevant to assessing the proposition. In the detailed distribution comparisons, hand-written parallel box plots were prepared to meet the remaining assignment requirements.

After completing our initial review of the data, we narrowed our investigations to the following three questions.

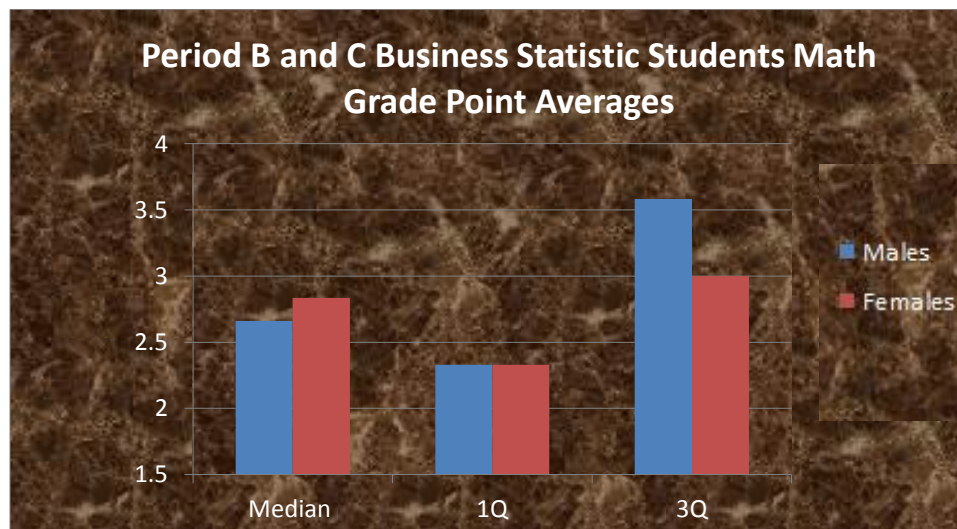
- #1 Do period C Business Statistic males score higher than period C Business Statistic females on Algebra 2 STAR tests?
- #2 Do period B and C Business Statistic males have higher math grade point averages than period B and C Business Statistic females?
- #3 Do period A and B Business Statistic males score higher on Geometry STAR tests than period A and B Business Statistic females?

# Summary of Findings

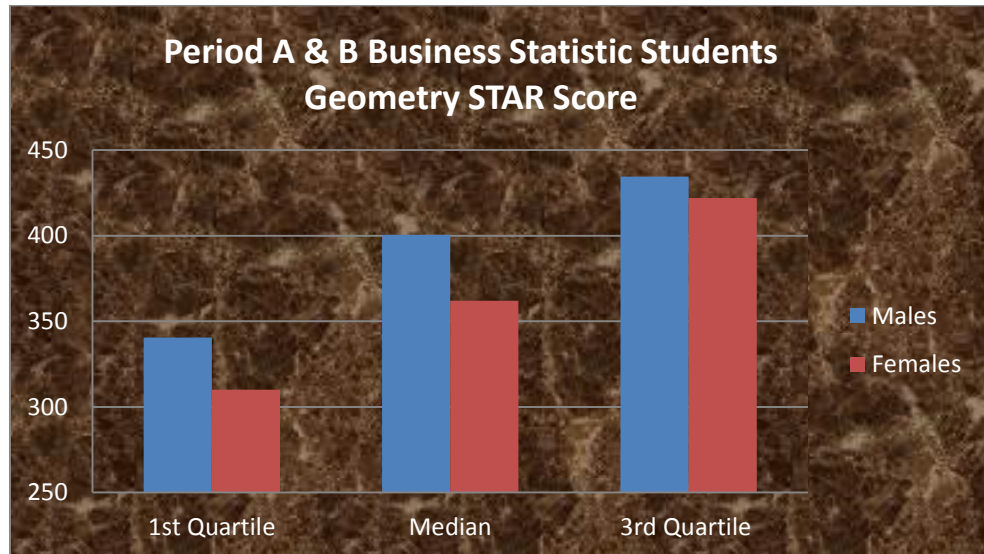
**Question #1:** Examination of Algebra 2 STAR scores for periods C and D Business Statistic students reveals: the first quartile value for males was only eight points higher than the first quartile value for females; the median for males was 16 points higher than the median value for females; and the third quartile for males was five points less than the third quartile value for females.



**Question #2:** Examination of math grade point average for periods B and C Business Statistics students reveals: the first quartile value for males was only one tenth of a point less than first quartile value for females; the median for males was two tenths of a point less points than females; and the third quartile value for males was two tenths of a point higher than the third quartile for females.



**Question #3:** Examination of Geometry STAR scores for periods A and B Business Statistic students reveals: the first quartile value for males was 30.5 points higher than the first quartile value for females; the median for males was 38.5 points higher than the median value for females; and the third quartile for males was 12.5 points less than the third quartile value for females.



## Conclusion

Based on these specific findings, we conclude the proposition is **supported**. **Males are better at math than females**. Males scored higher on the Geometry and Algebra 2 STAR exams. Math grade point averages did not show this pattern as clearly.

# Detailed Findings

The report has been organized as follows:

## Description of Distributions:

Algebra 2 STAR scores in the population of period C and D Business Statistic males .....	6
Algebra 2 STAR scores in the population of period C and D Business Statistic females.....	7
Math grade point averages in the population of period A and B Business Statistic males.....	9
Math grade point averages in the population of period A and B Business Statistic females.....	10
Geometry STAR scores in the population of period A and B Business Statistic males.....	12
Geometry STAR scores in the population of period A and B Business Statistic females.....	13

## Comparison Of Distributions:

<b>Table A.</b> compares distribution of <i>Algebra 2 STAR scores in the population of period C and D Business Statistic males; And Algebra 2 STAR Score in the population of period C Business Statistic females.</i> .....	8
<b>Table B.</b> compares distribution of <i>Math grade point average in the population of period A and B Business Statistic males; And Math grade point average in the population of period B Business Statistic females.</i> .....	11
<b>Table C.</b> compares distribution of <i>Geometry STAR scores in the population of period A and B Business Statistic males; And Geometry STAR scores in the population of period A and B Business Statistic females.</i> .....	14

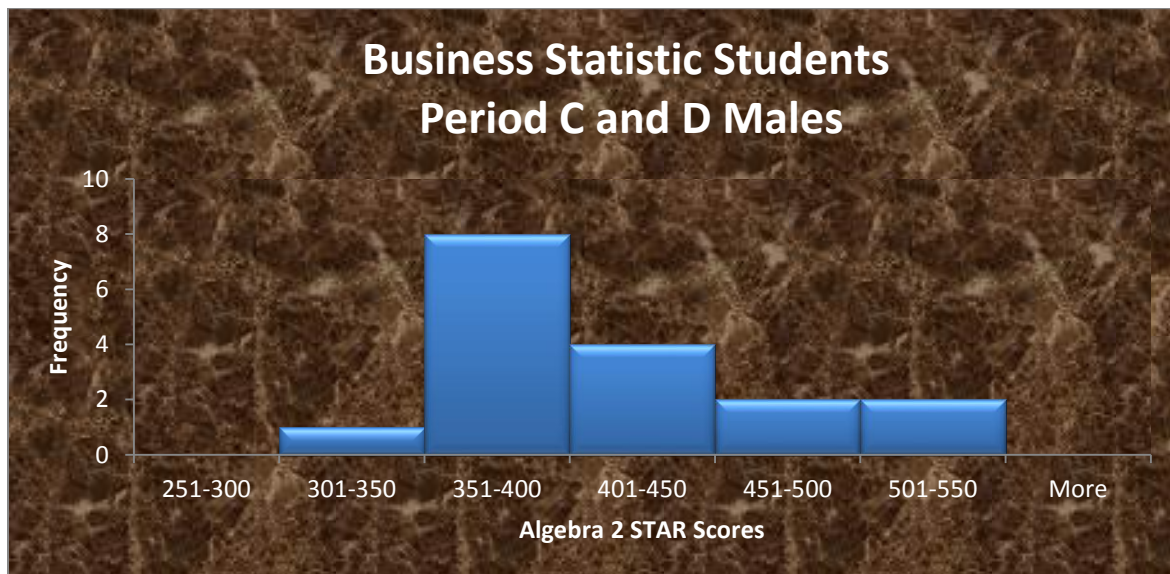
**Population:** *Period C and D Business Statistic males*

**Variable:** Algebra 2 Star Scores

**Type:** Quantitative, Interval, Continuous

**Shape:** A histogram was examined to determine the shape of the distribution. The histogram was displayed using a bin width of 50(point) increments. This plot was found to be unimodal and slightly skew right.

The Fisher skew statistic was .66 this statistic fell inside the computed range of -1.19 to +1.19 indicating that the distribution's shape is slightly skew right.



**Center:** Mean = 362points      Median = 350points      Mode = 474points

The best measure of central tendency is the median because the distribution is skewed. This skew right shape causes the mean to be greater than the median.

**Spread:** Range = 205 points      IQR = 76 points       $\sigma = 57.7$ points

The best measure of spread is the range and interquartile range because the distribution is skewed

**Outliers:** IQR Method: Adding 1.5 times the IQR to the third quartile value of 396 points results in an upper outlier threshold of 510points. Subtracting 1.5 times the IQR from the first quartile value of 320 points results in lower outlier threshold of 182 points. Examination of the data found no outliers that exceeded these thresholds.

Standard Deviation ( $\sigma$ ) Method: Adding and subtracting three standard deviations from the mean of 362pointsestablishes an upper outlier threshold of 537points and a lower threshold of 189points. Examination of the data found no outliers that exceeded these thresholds.

The best measure of outliers is the IQR Method because the distribution is Skew.

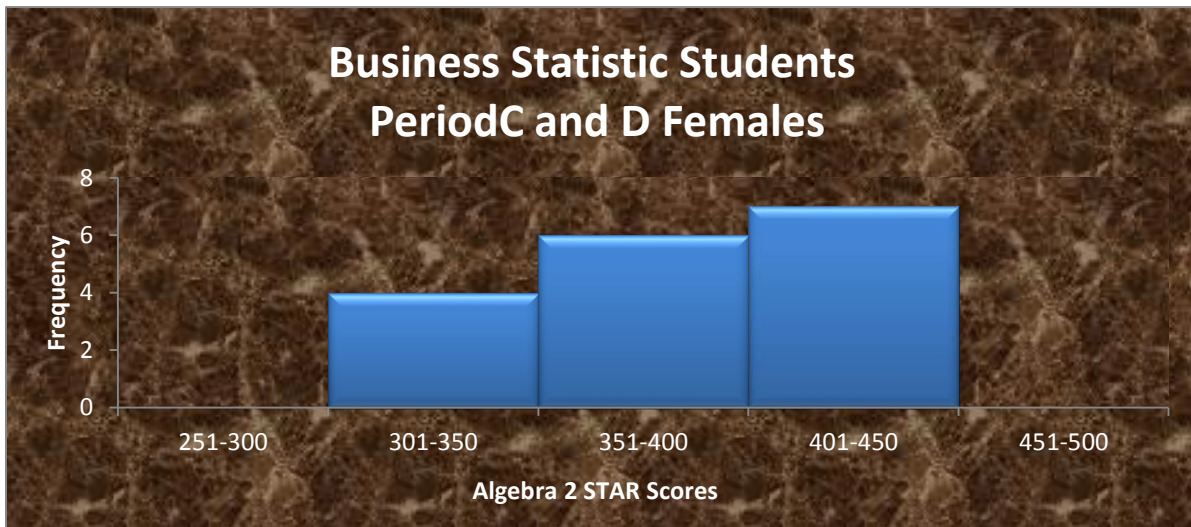
**Population:** *Period C and D Business Statistic males*

**Variable:** Algebra 2 Star scores

**Type:** Quantitative, Interval, Continuous

**Shape:** A Histogram was examined to determine the shape of the distribution. The Histogram was displayed using a bin width of 50 point increments. This plot was found to be unimodal and slightly skew left.

The Fisher skew statistic was .13. This statistic fell near 0 indicating that the distribution's shape is nearly symmetric.



**Center:** Mean = 341 points      Median = 334 points      Mode = 288 points

The best measure of central tendency is the Median because the distribution is skewed. This Skew left shape causes the mean to be greater than the median.

**Spread:** Range = 111 points      IQR = 88.5 points       $\sigma = 41.8$  points

The best measure of spread is the range and interquartile range because the distribution is skewed

**Outliers:** IQR Method: Adding 1.5 times the IQR to the third quartile value of 401 points results in an upper outlier threshold of 533 points. Subtracting 1.5 times the IQR from the first quartile value of 312 points results in a lower outlier threshold of 180 points. Examination of the data found no outliers that exceeded these thresholds

Standard Deviation ( $\sigma$ ) Method: Adding and subtracting three standard deviations from the mean of 341 points establishes an upper outlier threshold of 467 points and a lower threshold of 216 points. Examination of the data found no outliers that exceeded these thresholds.

The best measure of outliers is the IQR Method because the distribution is skewed.

**Variable:** Algebra 2 Star Scores in the population of Males in period C and D

**Variable:** Algebra 2 Scores in the population of Females in period C and D

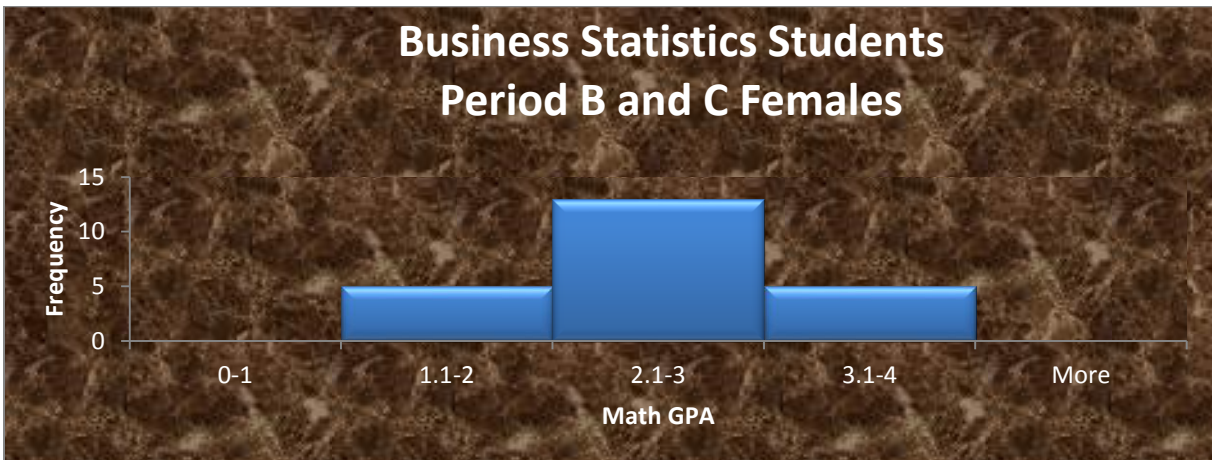
	Males	Females	Comparison
<b>Shape</b>	highly skew right	slightly skew left	The distribution for males star scores is highly skew right while the distribution for female star scores is slightly skew left
<b>Center</b>	Mean = 363 (points) Median = 350 (points)	Mean = 341 (points) Median = 334 (points)	Since both distributions are skewed, the best measure for comparing central tendencies is the median.  The center of the distribution for male star scores is about 16 units higher than the distribution for female star scores
<b>Spread</b>	Range = 205 (points) IQR = 76 (points) $\sigma = 57.7$ (points)	Range = 111 (points) IQR = 88.5 (points) $\sigma = 41.8$ (points)	Since both distributions are skewed, the best measure for comparing spread are the range and interquartile range.  Examination of these statistics shows the distribution for Male has more spread than the distribution for Female
<b>Outliers</b>	510 (points) and 282 (points) using the IQR Method	489 (points) and 224 (points) using the IQR Method	The distribution for Males has 1 outliers while the distribution for Females has none.

**Population: Business Statistics Period B and C Female Students**

**Variable: Math GPA**

**Type: Quantitative, Interval, Continuous**

**Shape:** A **histogram** was examined to determine the shape of the distribution. The **histogram** was displayed using a bin width of **1point** increments. This plot was found to be **unimodal** and **nearly symmetric**. The Fisher skew statistic was **0.12**. This statistic fell **near 0** indicating that the distribution's shape is **nearly symmetric**.



**Center:** Mean = **2.8points**, Median = **2.8points**, Mode = **3points**

The best measure of central tendency is the **mean** because the distribution is **symmetric**. This **symmetric** shape causes the mean to be **nearly equal to** the median.

**Spread:** Range = **4.3points** IQR = **.9 points**  $\sigma = .8points$

The best measure of spread is the **standard deviation** because the distribution is **symmetric**.

**Outliers:** IQR Method: Adding 1.5 times the IQR to the third quartile value of **3.2points** results in an upper outlier threshold of **4.6 points**. Subtracting 1.5 times the IQR from the first quartile value of **2.3points** results in a lower outlier threshold of **0.9 point**. Examination of the data found **1** outlier that exceeded these thresholds: **5.6**

Standard Deviation () Method: Adding and subtracting three standard deviations from the mean of **2.8points** establishes an upper outlier threshold of **5.4points** and a lower threshold of **0.1 points**. Examination of the data found **no** outliers that exceeded these thresholds, **none**.

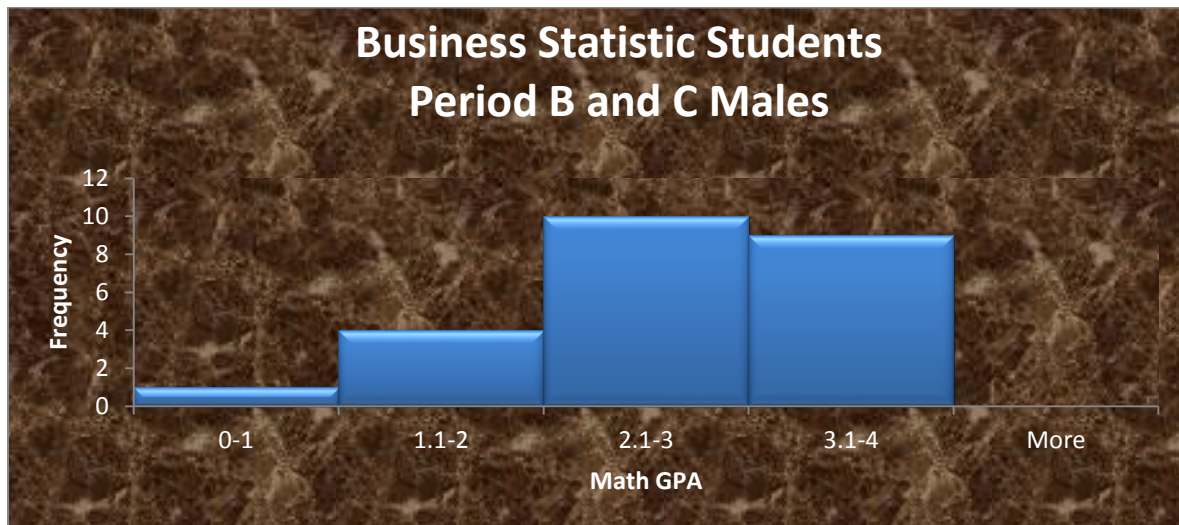
The best measure of outliers is the **Standard Deviation Method** because the distribution is **symmetric**.

**Population: Business Statistics Period B and C Male Students**

**Variable: Math GPA**      **Type: Quantitative, Interval, Continuous**

**Shape:** A histogram was examined to determine the shape of the distribution. The **histogram** was displayed using a bin width of **1 point** increments. This plot was found to be **unimodal** and **slightly skew left**.

The Fisher skew statistic was **-.3**. This statistic fell **near 0** indicating that the distribution's shape is **nearly symmetric**.



**Center:** Mean = **2.7 points**,      Median = **2.6 points**,      Mode = **2 points**

The best measure of central tendency is the **median** because the distribution is **skewed**. This **skew** shape causes the mean to be **greater than** the median.

**Spread:**      Range = **3 points**      IQR = **1.1 points**       $\sigma$  = **.8 points**

The best measure of spread is the **range and interquartile range** because the distribution is **skewed**

**Outliers:** IQR Method: Adding 1.5 times the IQR to the third quartile value of **3.4 points** results in an upper outlier threshold of **5.1 points**. Subtracting 1.5 times the IQR from the first quartile value of **2.2 points** results in a lower outlier threshold of **0.6 point**. Examination of the data found **no** outliers that exceeded these thresholds: **none**

Standard Deviation () Method: Adding and subtracting three standard deviations from the mean of **2.7 points** establishes an upper outlier threshold of **5.3 points** and a lower threshold of **0.1 points**. Examination of the data found **no** outliers that exceeded these thresholds, **none**.

The best measure of outliers is the **IQR Method** because the distribution is **skewed**.

Variable: **Math GPA for** in the population of **Period B and C Business Statistics Female Students**

Variable: **Math GPA** in the population of **Period B and C Business Statistics Male Students**

	<b>Females</b>	<b>Males</b>	<b>Comparison</b>
<b>Shape</b>	Near symmetric	slightly skew left	The distribution for <b>Overall Math GPA for Algebra 1, 2, and Geometry for Male Students</b> slightly skew left while the distribution for <b>Overall Math GPA for Algebra 1, 2, and Geometry for Female Students</b> nearly symmetric.
<b>Center</b>	Mean = 2.8 points) Median = 2.8 points	Mean = 2.7 points Median = 2.6 points	Since the distribution for <b>Overall Math GPA for Algebra 1, 2, and Geometry for Male Students</b> is skewed, the best measure for comparing central tendencies is the median.  The center of the distribution for <b>Overall Math GPA for Algebra 1, 2, and Geometry for Male Students</b> is about 0.2 units lower than the distribution for <b>Overall Math GPA for Algebra 1, 2, and Geometry for Female Students</b>
<b>Spread</b>	Range = 4.3 IQR = 0.9 $\sigma = 0.8$	Range = 3 IQR = 1.1 $\sigma = 0.8$	Since the distribution for <b>Overall Math GPA for Algebra 1, 2, and Geometry for Male Students</b> is skewed, the best measure for comparing spread is the range and interquartile range.  Examination of these statistics shows both distributions have similar spreads.
<b>Outliers</b>	0 Using the Standard Deviation Method	0 Using the IQR Method	Neither distribution has outliers.

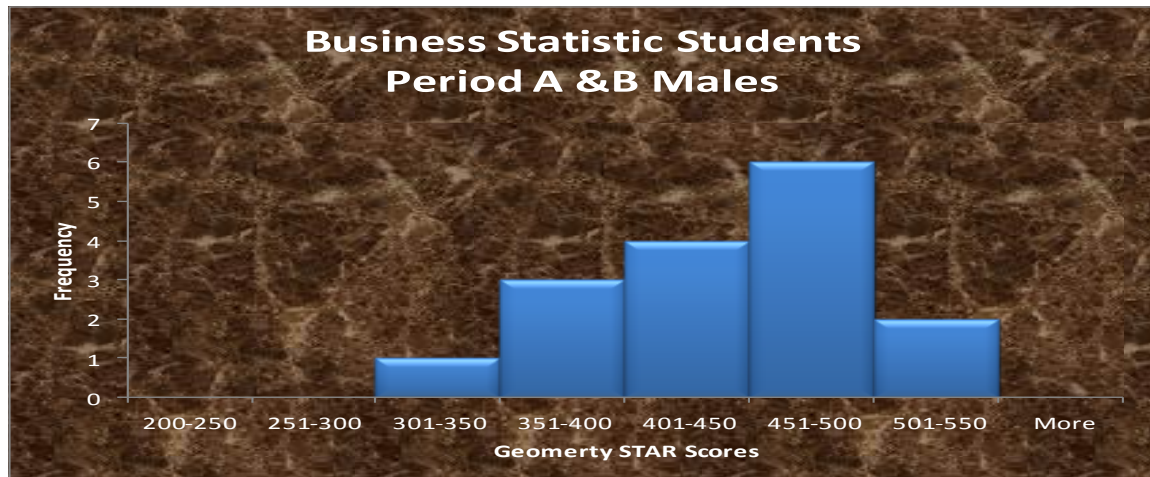
**Population:** Business Statistic Period A and B Males

**Variable:** Geometry STAR Score

**Type:** Quantitative Interval, Continuous

**Shape:** A histogram was examined to determine the shape of the distribution. The histogram was displayed using a bin width of 50 point increments. This plot was found to be unimodal and nearly symmetric.

The Fisher skew statistic was  $-0.06$ . This statistic fell near 0 indicating that the distribution's shape is nearly symmetric.



**Center:** Mean = 388.18 points, Median = 400.5 points, Mode = 441 points

The best measure of central tendency is the mean because the distribution is symmetric. This symmetric shape causes the mean to be nearly equal to the median.

**Spread:** Range = 206 points, IQR = 94 points,  $\hat{\sigma} = 57.6$  points

The best measure of spread is the Standard Deviation because the distribution is symmetric.

**Outliers:** IQR Method: Adding 1.5 times the IQR to the third quartile value of 434.5 points results in an upper outlier threshold of 575.5 points. Subtracting 1.5 times the IQR from the first quartile value of 340.5 points results in a lower outlier threshold of 199.5 points. Examination of the data found no outliers that exceeded these thresholds.

Standard Deviation ( $\hat{\sigma}$ ) Method: Adding and subtracting three standard deviations from the mean of 388.18 points establishes an upper outlier threshold of 561.06 points and a lower threshold of 215.32 points. Examination of the data found no outliers that exceeded these thresholds.

The best measure of outliers is the Standard Deviation because the distribution is symmetric

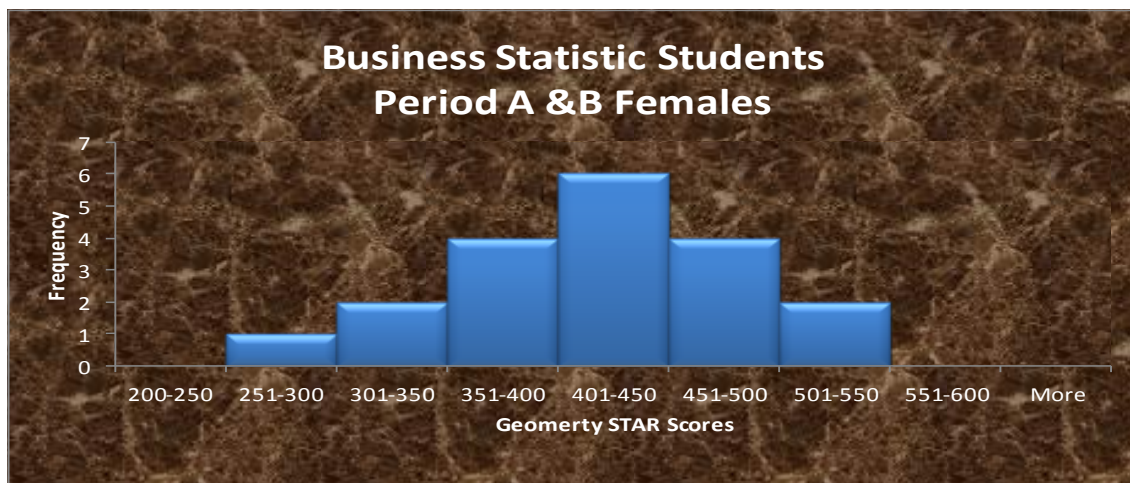
**Population:** Business Statistic Period A and B Females

**Variable:** Geometry STAR Score

**Type:** Quantitative Interval, Continuous

**Shape:** A histogram was examined to determine the shape of the distribution. The histogram was displayed using a bin width of 50 point increment. This plot was found to be unimodal and nearly symmetric.

The Fisher skew statistic was  $-0.26$ . This statistic fell near zero indicating that the distribution's shape is nearly symmetric.



**Center:** Mean = 363.1 points, Median = 362 points, Mode = 422 points

The best measure of central tendency is the mean because the distribution is symmetric. This symmetric shape causes the mean to be nearly equal to the median.

**Spread:** Range = 216 points, IQR = 112 points,  $\hat{\sigma} = 64.8$  points

The best measure of spread is the Standard Deviation because the distribution is symmetric.

**Outliers:** IQR Method: Adding 1.5 times the IQR to the third quartile value of 422 points results in an upper outlier threshold of 590 points. Subtracting 1.5 times the IQR from the first quartile value of 310 points results in a lower outlier threshold of 142 points. Examination of the data found no outliers that exceeded these thresholds.

Standard Deviation ( $\hat{\sigma}$ ) Method: Adding and subtracting three standard deviations from the mean of 363.1 points establishes an upper outlier threshold of 557.5 points and a lower threshold of 168 points. Examination of the data found no outliers that exceeded these thresholds.

The best measure of outliers is the Standard Deviation because the distribution is symmetric.

**Variable:** Geometry STAR Score in the population of Business Statistic Period a & B Males

**Variable:** Geometry STAR Score in the population of Business Statistic Period A & B Females

	<b>Males</b>	<b>Females</b>	<b>Comparison</b>
<b>Shape</b>	Near symmetric	Near symmetric	The distributions have the same shape.
<b>Center</b>	Mean = <b>388.18</b> points Median = <b>400.5</b> points	Mean = <b>363.1</b> points Median = <b>362</b> points	Since both distributions are nearly symmetric, the best measure for comparing central tendencies is the mean.  The center of the distribution for <b>Geometry STAR Score Males</b> is <b>about 25 units higher</b> than the distribution for <b>Geometry STAR Score Females</b> .
<b>Spread</b>	Range = <b>206</b> IQR = <b>94</b> S = <b>57.6</b>	Range = <b>216</b> IQR = <b>112</b> S = <b>64.8</b>	Since both distributions are nearly symmetric, the best measure for comparing spread is the standard deviation.  Examination of these statistics shows the distribution for <b>Geometry STAR Score Females</b> has more spread than the distribution for <b>Geometry STAR Score Males</b> .
<b>Outliers</b>	<b>None</b> using the <b>IQR Method</b>	<b>None</b> using the <b>IQR Method</b>	Neither distribution has outliers.