MATHEMATICS ATTITUDE IN FIFTH AND SIXTH GRADE STUDENTS

By

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ABSTRACT

This paper examines mathematical attitude of students in the fifth grade to sixth grade. Two geographical regions in Texas with different ethnic distributions were surveyed. In addition to the impact of grade level, the study investigates the influence of gender, ethnicity and region on student attitude toward mathematics. Attitude was measured using the Math and Me survey constructed by Adelson and McCoach [1], which considers attitude based on student's mathematical self-perceptions and their enjoyment of mathematics. The analysis performed provides evidence that the transition into the sixth grade had a negative effect on student attitude. Multivariate analysis indicated that grade is the only main effect of significance impacting overall attitude however, all other factors considered are present in significant interactions.

ACKNOWLEDGEMENTS

I am, of course, grateful to God, who I believe granted me an interest and value in mathematics. I can look back and see His provision in many amazing ways. I am also thankful for my family, who supported me through my education; especially my mother who has invested so much of herself in this and all other aspects of my life, my dad who loved me constantly, and my brother who always encourages me to pursue what I'm passionate about. I would also like to thank Dr. Lockwood, Dr. Seth, Dr. Combs, Mr. Ambrose, and Dr. Gill who taught me, encouraged me, spurred me on, and were patient with me. For Brittany and Roo, thank you for being so encouraging and allowing me to verbally process with you even when you didn't know what I was talking about. For Ryan, thank you for helping me find the right people to talk to in order to get things done. For Ian, thank you for taking time from leave with your family to edit my work. For Kyle, who is 25 and too old to participate in the study but really wanted to be part of a thesis, I could at least list you here. For the districts, principals, teachers and students who gave me their time and input, thank you as well.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

In a world that is always seeking the next technological advancement there is an ever-present need for students pursuing science, technology, engineering and mathematics (STEM) fields. This suggests an increased need for research into ways to retain and improve interest in mathematics. The purpose of this study is to determine if student attitudes towards mathematics decline in the transition between fifth and sixth grade. The result of this transition is investigated further by analyzing the impact of gender, ethnicity and geographical region. Identification of factors influencing attitude, as well as the extent of that influence allows steps to be taken to address these effects with the hope of increasing overall attitude and performance in mathematics.

Studies have documented that gender and ethnicity are significant factors in mathematics performance [5]. Past studies show that a fall in performance is frequently preceded by a negative change in attitude towards the subject [12, 18]. The statistical analysis undertaken herein is designed to assess attitudes towards mathematics of fifth and sixth grade students in two different geographical regions in Texas. The intent is to determine if region and grade level, as well as gender and ethnicity, impact student attitudes towards mathematics. To this end, we will describe the process of collecting and analyzing data and conclude with the results, addressing these research questions:

Research Questions:

1. Do student self-perceptions of ability and enjoyment of mathematics change between grade 5 and 6?
2. Is gender associated with differences in student self-perceptions of ability and enjoyment of mathematics in middle school students?
3. Is race associated with differences in student self-perceptions of ability and enjoyment of mathematics in middle school students?
4. Is geographical region associated with differences in student self-perceptions of ability and enjoyment of mathematics in middle school students?

Chapter 2 of this study explores what previous literature has already found about factors impacting students attitude towards mathematics. Chapter 3 describes the process of collecting and analyzing data. Chapter 4 is an exploration of the data using descriptive statistics and graphics. Chapter 5 seeks to draw stronger conclusions about the data using inferential statistics. Chapter 6 concludes analysis and makes final conclusions about the analysis.

CHAPTER II

LITERATURE REVIEW

The need for increased interest and performance in mathematics makes it important to understand what factors are likely to affect those traits in a student. Awareness of student attitude in mathematics is an important step in improving student performance. Behaviors that contribute to achievement in mathematics often stem from attitude towards mathematics [11, 17]. Adelson and McCoach measure attitude by evaluating self-perception and enjoyment [1]. They note that students are more likely to be attentive, remain engaged in the classroom and persist through academic challenges when the enjoy the material and have high self-perception of their abilities [1].

As Adelson noted, “whether or not students develop a sense of valuing math and reading during elementary and middle school years can have profound effects on students’ future plans and potential career trajectories” [1]. Students’ attitudes towards mathematics have been found to decrease over time through middle school and high school [18]. Historically, research finds that students transitioning into middle school experience a reduction in academic value and motivation [4].

A lack of female interest in mathematics is a problem in many countries [7, 16]. As of 2011, the U. S. Department of Commerce, Economics and Statistics Administration showed that women made up less than 25% of the STEM workforce nationally although they constitute half of the overall workforce [9]. The trend of men outnumbering women in mathematics appears to begin when students are young. In the early years of schooling girls tend to perform on the same level as their male counterparts, however by the time they reach middle school a gender gap begins to appear [10, 18]. The gap begins with attitude and self-perception, and later translates into performance, eventually resulting in boys being more likely to pursue advanced mathematics classes as well as being more likely to show interest in math and science careers [2, 6, 14]. Several theories explain why this gap occurs. Studies suggest that even in early elementary school students begin to demonstrate awareness of math-gender stereotypes that influence the choices they make with regards to pursuing mathematics [6]. Other theories involve changes that are associated with reaching middle school. In middle school, students are frequently met with a greater number of male teachers and a more competitive learning environment which may cause girls to lose interest and confidence as well [2].

Multiple studies target the impact of ethnicity on mathematical performance and attitude. Information gathered from the Division of Science Resources Statistics in 2012 found minorities to be underrepresented among STEM jobs at the time [19]. The data also showed that women of ethnic minorities only held 8% of the STEM jobs in the United States. Differences in mathematical achievement between racial groups tend to be greater than differences found between genders [2, 8]. Past studies have generally found Asian American students to perform the best in mathematics followed by Caucasian students, whereas African American and Latino students have lower achievement [5]. Though achievement gaps between ethnicities are present, that is not always the case for attitude. Research found African American and Latino youth to enjoy mathematics just as much as, if not more than, their Caucasian counterparts [12]. Catsambis and Reigle-Crumb et. al, independently reached the same conclusions. Catsambis suggests the relationship between attitude and achievement may not be present in all ethnic groups [2, 12].

How gender and ethnicity interact to effect attitude and achievement in mathematics has been investigated in previous research. Interestingly, Catsambis found that gender differences in attitude towards mathematics varied among ethnicities with the greatest gender differences existing among Latino students [2]. Reigle-Crumb et. al. data found a larger percentage of students with strong enjoyment of mathematics to be African American males, African American females and Hispanic males. They were followed by Caucasian male students, 20% of whom reported a strong enjoyment of mathematics, a number comparable to Hispanic females [12]. The subgroup with the fewest members reporting a strong enjoyment of mathematics was Caucasian females. Catsambis found that though females reported greater anxiety associated with mathematics in all ethnic groups, the greatest disparity existed among Latinos and the smallest difference among African American students [2]. The effects of ethnicity, and its interactions with gender, is a vital area of research in understanding student attitude and achievement in mathematics.

There is abundant research to indicate that a decrease in student’s achievement in mathematics is preceded by a worsening attitude towards mathematics. It is beneficial to determine where this decline in interest begins. Once this point is identified further research can be carried out, possibly leading to intervention strategies that may improve or maintain attitude instead.

CHAPTER III

METHODOLOGY

For the purposes of this study, the mathematical attitudes of fifth and sixth grade students from school districts in two different geographical regions were measured. This was done using the “Math and Me” survey [1], which defines mathematical attitude as a combination of mathematical self-perception and enjoyment of mathematics.

Region 1 was a small urban city surrounded by rural populations. It is the most ethnically diverse of the regions as seen in Table 1. Two districts in this region were surveyed; there were forty-four participating schools from the larger district and two from the smaller district. The larger district’s self-reported demographics are 35.6% White students, 45.6% Hispanic students, 9.9% African American students, 5.5% Asian and Pacific Islander students, and 0.5% Native American and Alaska Native students. The second school district in Region 1 reported its overall demographics to be 69.57% White students, 24.52% Hispanic students, 2.53% African American students, 1.24% Asian and Pacific Islander students, 0.1% Native American and Alaska Native students and 1.59% multiracial students.

Region 2 was a large, predominately Hispanic urban city. One district from Region 2 was surveyed. The district from Region 2 reported the following overall demographics: 3.1% White students, 94% Hispanic students, 1.4% African American students, less than 1% Asian and Pacific Islander students, less than 1% Native American and Alaska Native students, and less than 1% multiracial students.

Table 1: Self-Reported Regional Demographics

	Region 1 District 1	Region 1 District 2	Region 2
White	35.60%	69.57%	3.10%
Hispanic	45.60%	24.52%	94.00%
African American	9.90%	2.53%	1.40%
Asian and Pacific Islander	5.50%	1.24%	<1.00%
Native American and Alaska Native	0.50%	0.10%	<1.00%
Multiracial	0.00%	1.59%	<1.00%

IRB approval was obtained in Region 1 first and then in Region 2. After approval from school districts in these regions was attained school principals were contacted requesting their participation. Schools agreeing to participate each received surveys to disseminate to their students. Once the schools completed administration of the surveys they were collected by researchers.

There was a significant difference in participation between Region 1 and Region 2. Region 1 had 5,361 participants whereas the Region 2 had 375. This resulted in a sampling bias. To address the bias, two samples were taken from Region 1 responses. The first was a *selective sample* was taken from Region 1 responses to create an ethnic distribution similar to the Region 2 responses. This should ensure that inferences or observations made about the regional effects were based solely on region and not as a result of ethnicity bias.

The data set formed using a *selective sample* contained 11.20% White students, 48.80% Hispanic students, 6.93% Black students, 7.47% Asian and Pacific Islander students, 2.40% Native American and Alaska Native students, 22.93% Multiracial students, and 0.27% who did not provide their ethnicity. This distribution was comparable to the results from Region 2 which showed 8.80% White students, 66.67% Hispanic students, 2.93% Black students, 1.07% Asian and Pacific Islander students, 1.60% Native American and Pacific Islander students, and 16.00% multiracial students, with the remaining 2.93% withholding their ethnicity as shown in Table 2.

Table 2: Sample Demographics

	Region 1 *Selective Sample*		Region 1 *Random Sample*		Region 2 Sample	
	Percentage	Number	Percentage	Number	Percentage	Number
White	11.20%	42	31.20%	117	8.80%	33
Hispanic	48.80%	183	25.87%	97	66.67%	250
African American	6.93%	26	6.93%	26	2.93%	11
Asian and Pacific Islander	7.47%	28	2.93%	11	1.07%	4
Native American and Alaska Native	2.40%	9	1.87%	7	1.60%	6
Multiracial	22.93%	86	30.40%	114	2.93%	60

Concerns that claims made about Region 1 would not truly represent the region were formed following analysis of the data set formed using the *selective sample*. A random sample was taken to provide a more ethnically diverse representation of Region 1. As seen in Table 2, the *random sample* of Region 1 data was comprised of 31.20% White students, 25.87% Hispanic students, 6.93% Black students, 2.93% Asian and Pacific Islander students, 1.87% Native American and Alaska Native students, 30.40% Multiracial students and 0.80% of students choosing not to disclose their ethnicity. A significant difference was found between the percentage of multiracial students reported by the district and those found in the samples, most likely due to differences in how ethnicity is recorded. It is likely that most Multiracial students identify as Hispanic, having at least one Hispanic parent.

This study used the “Math and Me Survey” by Adelson and McCoach to investigate student attitudes towards mathematics [1]. The survey was appropriate for this study because it was created specifically to measure mathematical attitudes of Elementary age students. More specifically, the Math and Me Survey was designed to measure student attitude in terms of their self-perceptions of their mathematical abilities and their enjoyment of mathematics. In the survey, phrases such as “I understand math” or “math is fun” were presented. Each phrase was associated either with self-perception or enjoyment. Student responses were measured using a Likert scale allowing them to either, strongly disagree, disagree, feel neutral, agree or strongly agree with the statement. For analysis purposes, each response was then correlated to a numerical value from one to five. One means the student response was highly negative and five means that the student response was highly positive. The responses were then summed for each student to determine a score of their individual self-perception and enjoyment.

Descriptive statistics and graphics were used to analyze both the *selective sample* combined with Region 2 data and the *random sample* combined with the Region 2 data separately. Box plots along with mean and standard deviation comparing fifth and sixth grade self-perception and enjoyment scores were used to show any differences that may be present between grade levels. This was followed by comparisons of grade level by gender, by ethnicity, and by region, allowing for enlightenment into how each of those factors were associated with differences in self-perception and enjoyment scores. Descriptive analysis continued by exploring potential interactions between gender and ethnicity, gender and region, and ethnicity and region. Once the initial exploration was completed, the differences between the two samples from Region 1 were investigated to determine the strengths and weaknesses of each.

The final stage of the study was building a Multivariate Analysis of Variance (MANOVA) to understand the larger picture of which factors and interactions may have a significant impact on attitude as a whole. MANOVA allows for analysis with multiple dependent and independent variables, enabling analysis of attitude as the composite of the dependent variables self-perception and enjoyment. Furthermore, MANOVA controls for the cases where the outcome variables are correlated, making if preferable to running separate ANOVA models, which would not. Individual Univariant Analysis of Variance (ANOVA) tests were run once an appropriate MANOVA model was developed to further clarify how the factors influenced the different facets of attitude. The ANOVA results helped to determine which factors had the most impact on either self-perception or enjoyment respectively, post hoc testing was conducted to better understand the scope of the influence factors had on the different elements of mathematical attitude.

CHAPTER IV

DATA EXPLORATION

Data exploration will provide visual representations of the data that begin to answer the research questions. The impact of grade level on attitude towards mathematics will be explored as well as how gender, ethnicity and geographical region are associated with any differences found. Exploration is divided into three main sections. First the data set formed using a *selective sample* from Region 1 combined with the Region 2 data is investigated. Then the data collected using a *random sample* and the Region 2 data is considered. The chapter concludes with an investigation into the differences between the Region 1 samples to identify biases that may be present in the data sets.

***Selective Sample* Analysis**

Grade

The impact of grade level may be illustrated for the two facets of mathematical attitude using a *selective sample* from Region 1. Consider Figure 1 and Table 3. While in the fifth grade 50.45% of students reported self-perception scores of at least 30 out of a possible 40 and have an overall average score of 29.045. Only 34.11% of sixth grade students scored 30 or greater and the average self-perception score is 26.605. This indicates an overall shift towards lower scores among sixth grade students. A similar trend is seen in enjoyment scores as well. With a maximum possible score of 50, 47.75%

of fifth grade students reported enjoyment scores of at least 40 while only 37.89% of sixth grade students reported enjoyment scores of at least 40. The average enjoyment scores decrease from 37.880 in the fifth grade to 35.716 in the sixth grade while maintaining similar standard deviations. It is evident that both self-perception of mathematic ability and enjoyment of mathematics fall in the transition from fifth to sixth grade using the *selective sample*.

Figure 1: Selective Sample Attitude by Grade

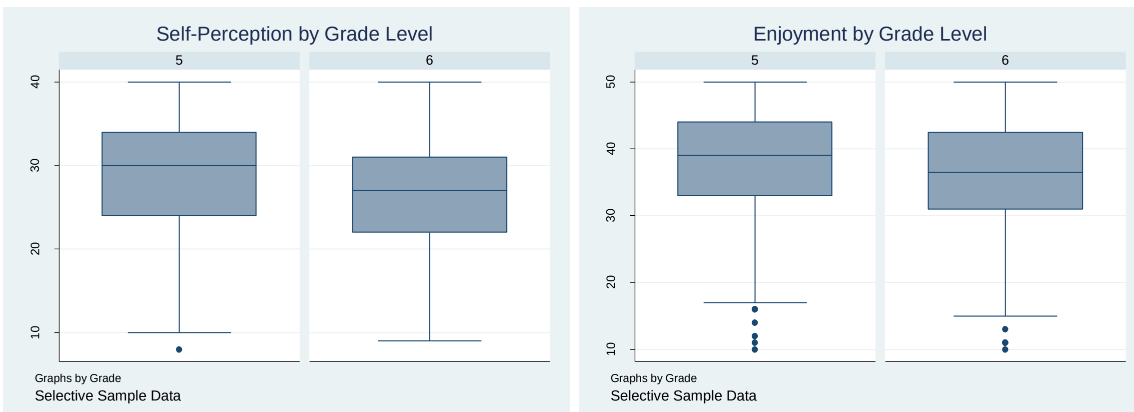


Table 3: Selective Sample Attitude Statistics by Grade

	Self-Perception			Enjoyment		
	$\bar{x}$	s	n	$\bar{x}$	s	n
Fifth Grade	29.045	6.697	337	37.880	8.033	333
Sixth Grade	26.605	6.818	387	35.716	8.961	388

<u>Grade and Gender</u>

The effects of the transition from fifth to sixth grade among boys and girls are considered separately to understand how gender is associated with changes in attitude. A summary is provided in Figure 2 and Table 4. The data indicates that 52.53% of fifth grade boys and 36.60% of sixth grade boys reported self-perception scores of at least 30.

The average self-perception score among fifth grade boys is 29.582 and drops to 27.211 for sixth grade boys. A similar drop is seen among girls with 48.60% of fifth grade girls and 31.77% of sixth grade girls reporting self-perception scores of at least 30. The average self-perception score for girls falls as well from 28.570 in the fifth grade to 25.984 in the sixth grade. The scores for enjoyment scores also have a negative trend in the transition from fifth to sixth grade for both genders. For boys 50.00% of fifth graders and 40.72% of sixth graders report enjoyment scores of at least 40 and the average drops 2.789 points. The drop in enjoyment scores is not as far among girls, 45.51% of fifth grade girls and 34.72% of sixth grade girls report enjoyment levels of 40 or greater and the change in average is 1.526 points.

Figure 2: Selective Sample Attitude by Grade and Gender

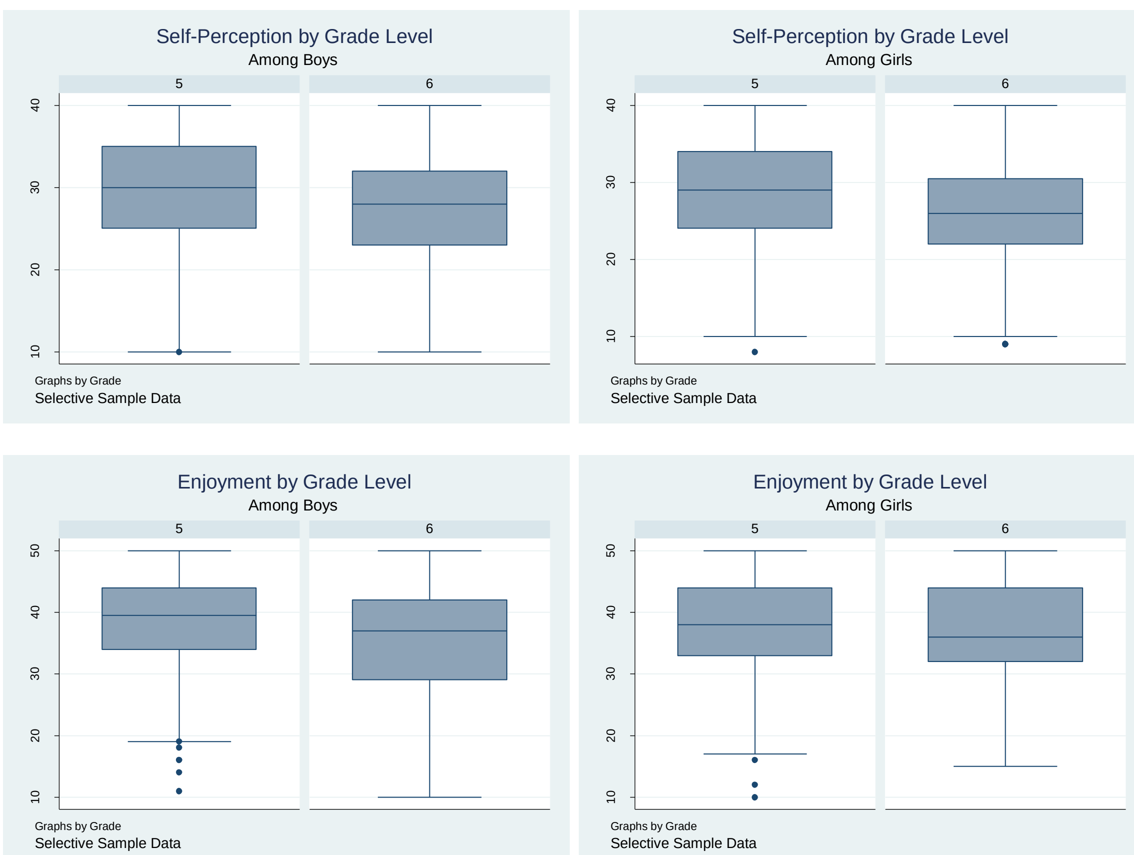


Table 4: Selective Sample Attitude Statics by Grade and Gender

		Self-Perception			Enjoyment		
		$\bar{x}$	s	n		s	n
Boys	Fifth Grade	29.582	6.354	158	37.825	8.183	154
	Sixth Grade	27.211	7.148	194	35.036	9.859	194
Girls	Fifth Grade	28.570	6.969	179	37.899	7.936	178
	Sixth Grade	25.984	6.445	192	36.373	7.944	193

The transition from fifth grade to sixth grade appears to have similar effects on both boys and girls. Students with self-perception scores above 29 dropped by about 16% and the number of students scoring at least 40 in enjoyment fell by about 10%. The impact of grade level on enjoyment of mathematics appears to be smaller among girls. The data suggests that overall boys report higher self-perception and enjoyment scores than girls, indicating that gender may have an impact on attitude as well.

Grade and Ethnicity

A difference in self-perception among grade levels may be seen in Figure 3 and Table 5. There is a drastic fall in self-perception scores among White students. Here 44.44% of fifth grade students report self-perception scores of at least 30 and for sixth grade students that statistic falls to 25.53% and the average score drops by 5.194 points with a growth in standard deviation of 1.295. Among Hispanic students the percentage of participants reporting a self-perception score of at least 30 is 50.69% of fifth grade students and 37.62% of sixth grade students. The drop seen in average scores is smaller than the one observed in White students, with the fifth grade average being 1.748 points with similar standard deviations. Among Black students, 50.00% of fifth grade students and 21.74% of sixth grade students report their self-perception levels to be at least 30. There were 8 and 24 fifth and sixth grade Asian and Pacific Islander students respectively, and 6 and 9 fifth and sixth grade Native American and Alaska Native students respectively, which was not enough to make claims in the study about the influence of their ethnic origins. Multiracial student proportions are 54.10% of fifth grade students and 44.44% of sixth grade students with self-perception levels of at least 30. Among the ethnic groups with high sample populations in this study however, multiracial students show the smallest drop in average scores self-perception scores. Their average of 28.574 in the fifth grade becomes 27.840 in the sixth grade. The change in standard deviation among multiracial students is greater than the change in score average. The data suggests that there is a drop in self-perception scores among sixth grade students of all ethnicities and is most noticeable for White students.

Figure 3: Selective Sample Self-Perception by Grade and Ethnicity

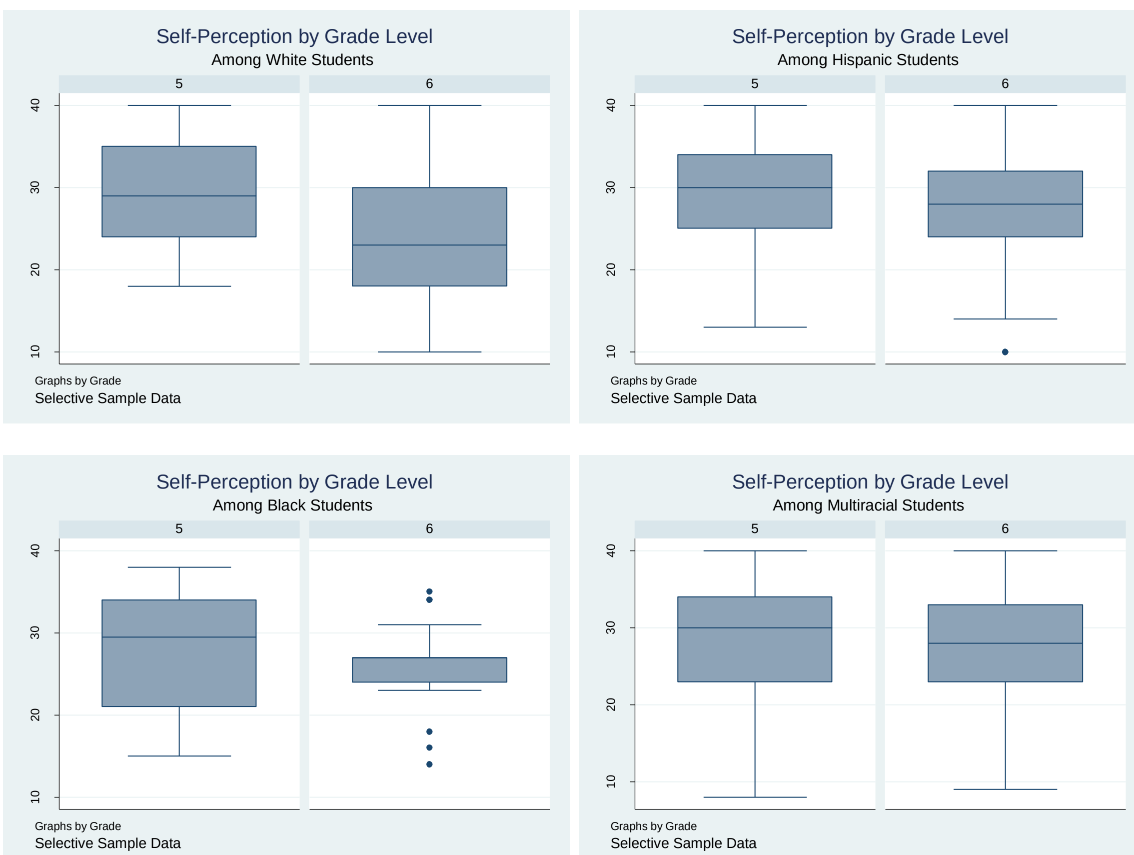


Table 5: Selective Sample Self-Perception Statistics by Grade and Ethnicity

Self-Perception		$\bar{x}$	s	n
White	Fifth Grade	29.407	6.185	27
	Sixth Grade	24.213	7.480	47
Hispanic	Fifth Grade	29.327	6.255	217
	Sixth Grade	27.579	6.126	202
Black	Fifth Grade	27.833	7.685	12
	Sixth Grade	26.043	5.235	23
Asian and Pacific Islander	Fifth Grade	27.250	3.845	8
	Sixth Grade	20.333	6.696	24
Native American and Alaska Native	Fifth Grade	29.667	7.528	6
	Sixth Grade	25.222	5.869	9
Multiracial	Fifth Grade	28.574	8.263	61
	Sixth Grade	27.840	7.322	81

Enjoyment of mathematics varies by grade level for each of the ethnic groups as well as seen in Figure 4 and Table 6. For white students, 51.85% of fifth graders and 27.66% of sixth graders report enjoyment levels of at least 40. A drop in average score is seen among White students with the average among fifth graders being 38.963 and for sixth graders being 31.128. The face that most fifth grade White students reported enjoyment levels of at least 40 but the average is below 40 points to several low-scoring outliers as well. Among Hispanic students, 49.53% of fifth grade students and 39.90% of sixth grade students have enjoyment levels of at least 40. Despite the significant drop in high scores, the difference in average is just 1.154, with the average for fifth graders being 38.208 and the average for sixth graders being 37.054. The portion of Black students reporting enjoyment levels of at least 40, a statistic that grows to 45.68% in the sixth grade. Multiracial students in the fifth grade show 38.33% of students reporting enjoyment of at least 40, a statistic that grows to 45.68% in the sixth grade. There is a slight drop seen in average scores among Multiracial students; however, with the fifth grade students having an average of 36.300 and sixth grade students having an average of 35.642 The only ethnic group with significant representation that demonstrates possible improvement in enjoyment of mathematics is Multiracial students.

Figure 4: Selective Enjoyment by Grade and Ethnicity

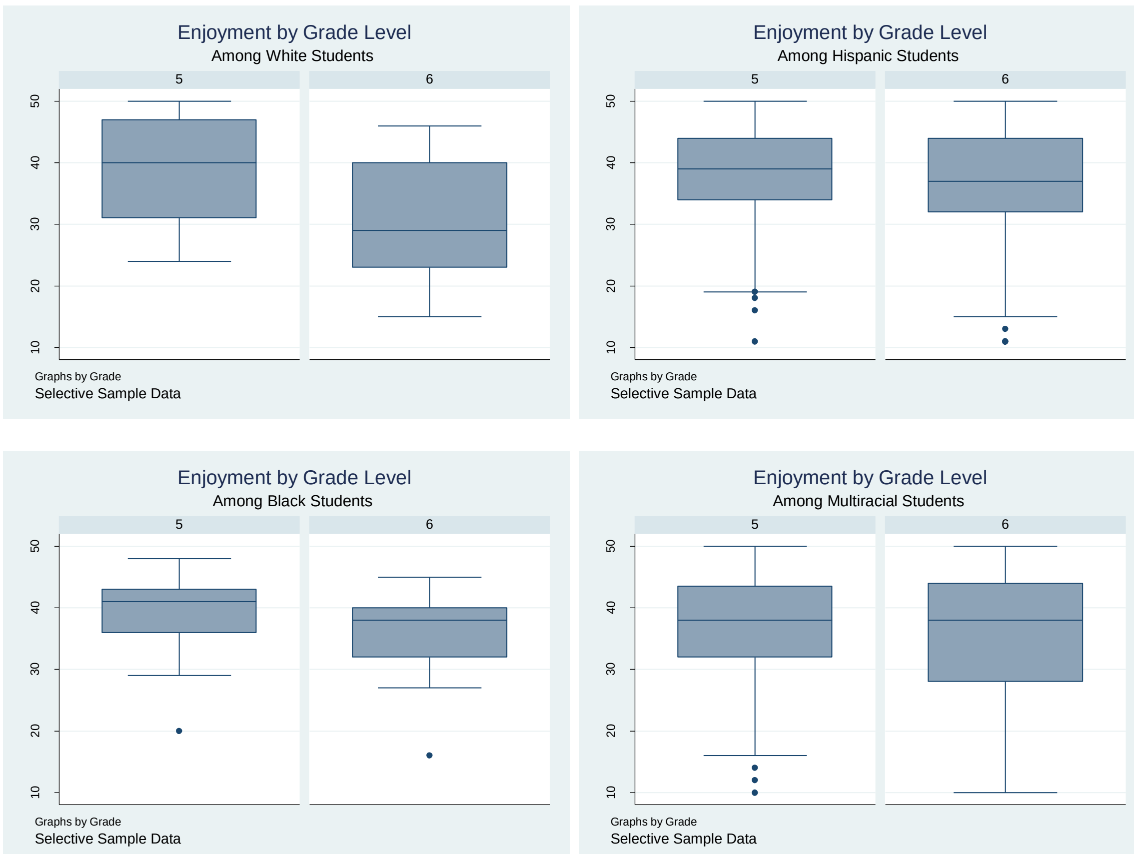


Table 6: Selective Sample Enjoyment Statistics by Grade and Ethnicity

Enjoyment		$\bar{x}$	s	n
White	Fifth Grade	38.963	7.896	27
	Sixth Grade	31.128	9.918	47
Hispanic	Fifth Grade	38.208	7.511	212
	Sixth Grade	37.054	8.377	203
Black	Fifth Grade	38.615	7.848	13
	Sixth Grade	35.696	6.219	23
Asian and Pacific Islander	Fifth Grade	37.875	4.454	8
	Sixth Grade	33.333	8.641	24
Native American and Alaska Native	Fifth Grade	37.167	12.513	6
	Sixth Grade	37.556	5.102	9
Multiracial	Fifth Grade	36.300	9.912	60
	Sixth Grade	35.642	10.003	81

Grade and Region

The final factor investigated is the effect of geographical region on attitude portrayed in Figure 5 and Table 7. The average self-perception score among fifth graders in Region 1 using the *selective sample* is 29.043 with 52.14% of reporting scores of at least 30. In the sixth grade that average drops to 26.300 with 31.23% of students reporting high scores. Students in Region 2 experience similar trends in student self-perception. The average of all self-perception scores from Region 2 fifth graders is 29.045 with 49.55% scoring at least 30. That average falls to 27.179 among sixth graders with 39.55% reporting levels of at least 30. Self-perception in Region 1 appears to be slightly more impacted by grade level than in Region 2.

Figure 5: Selective Sample Attitude by Grade and Region

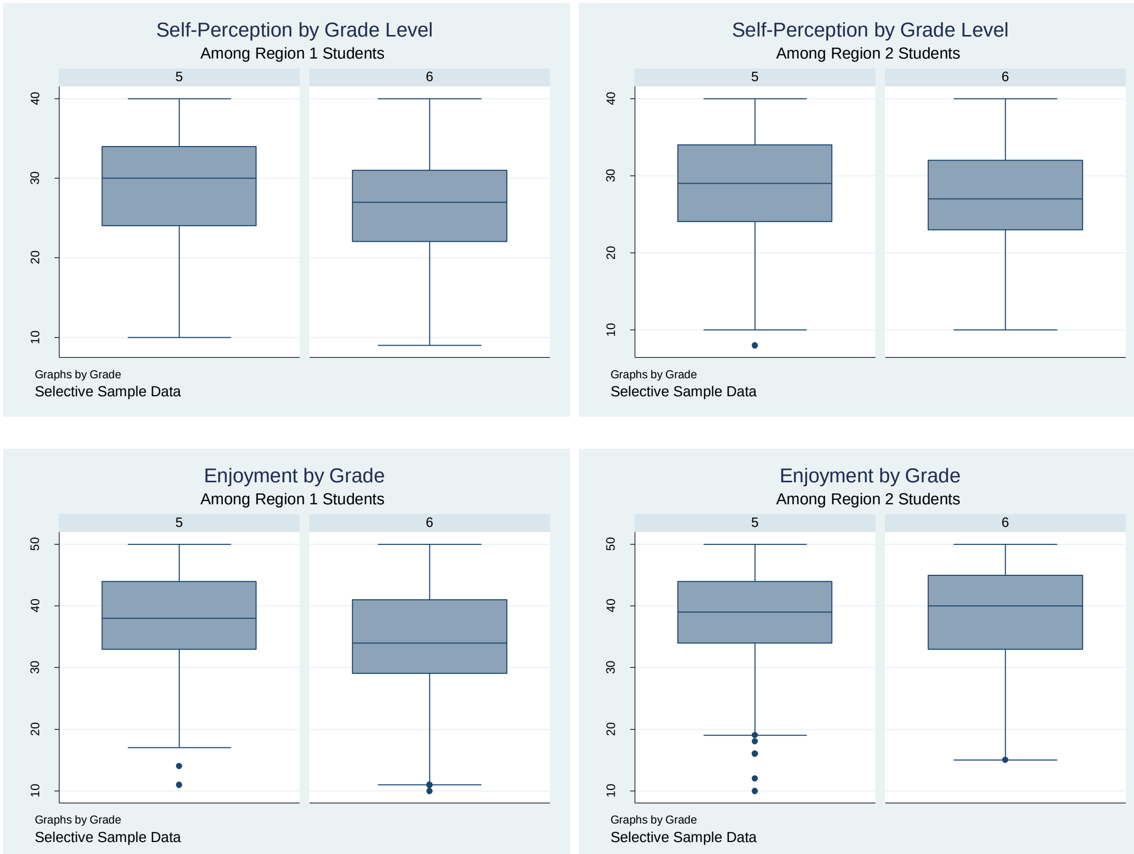


Table 7: Selective Sample Attitude Statistics by Grade and Region

		Self-Perception			Enjoyment		
		$\bar{x}$	s	n	$\bar{x}$	s	n
Region 1	Fifth Grade	29.043	6.616	117	37.470	8.546	117
	Sixth Grade	26.300	6.997	220	34.174	9.217	216
Region 2	Fifth Grade	29.045	6.755	220	38.102	7.752	216
	Sixth Grade	27.179	6.451	134	38.607	7.697	135

There is a fall in enjoyment from 47.01% of fifth grade students to 29.64% of sixth grade students from Region 1 that scored 40 or above and a drop in enjoyment score average of 3.296 points. However, Region 2 students demonstrate a possible improvement in enjoyment scores upon entering the sixth grade. While 48.15% of fifth grade students in Region 2 report scores of at least 40, that percentage grows to 53.33% among sixth grade students. The enjoyment score averages and standard deviations remain similar across grade levels however. This suggests that there may be an interaction effect present between region and grade level.

Region may have a significant impact on student mathematical attitude. The difference in the percentage of students scoring at least 30 is nearly twice as large in Region 1 as it is in Region 2. Self-perception in Region 1 appears to be more impacted by grade level than in Region 2. Enjoyment levels do not follow the same trends as self-perception. While Region 1 demonstrates a large loss in percentage of high-scoring students in enjoyment level, Region 2 students experience an improvement.

In most groups, mathematical attitude tends to decrease with the transition to the sixth grade based upon the data set using the *selective sample*. Two exceptions to this negative trend occur among multiracial students and Region 2 students with regards to enjoyment levels. Of the ethnic groups, White students appear to be the most affected by grade level. The mathematical attitude of boys and girls are similarly affected by grade level, though enjoyment levels drop slightly more for boys than for girls upon entering the sixth grade.

Gender and Ethnicity

Potential interactions between grade and gender, grade and ethnicity, and grade and region have been investigated. Analysis continues by exploring the interaction between gender and ethnicity. Prior research has found variation in the attitude differences by gender among ethnic groups; with the greatest disparity between boys and girls found between Hispanic students and the smallest among Black students [2]. Trends among all ethnicities are not consistent across genders in the current data as seen in Figure 6 and Table 8. Differences are evident between White students and Multiracial students. Among White students, girls report higher self-perception than boys; alternatively, among Multiracial students, boys report higher self-perception scores.

Figure 6: Selective Sample Self-Perception by Gender and Ethnicity

Note That 1 Indicate Boys and 2 Indicates Girls

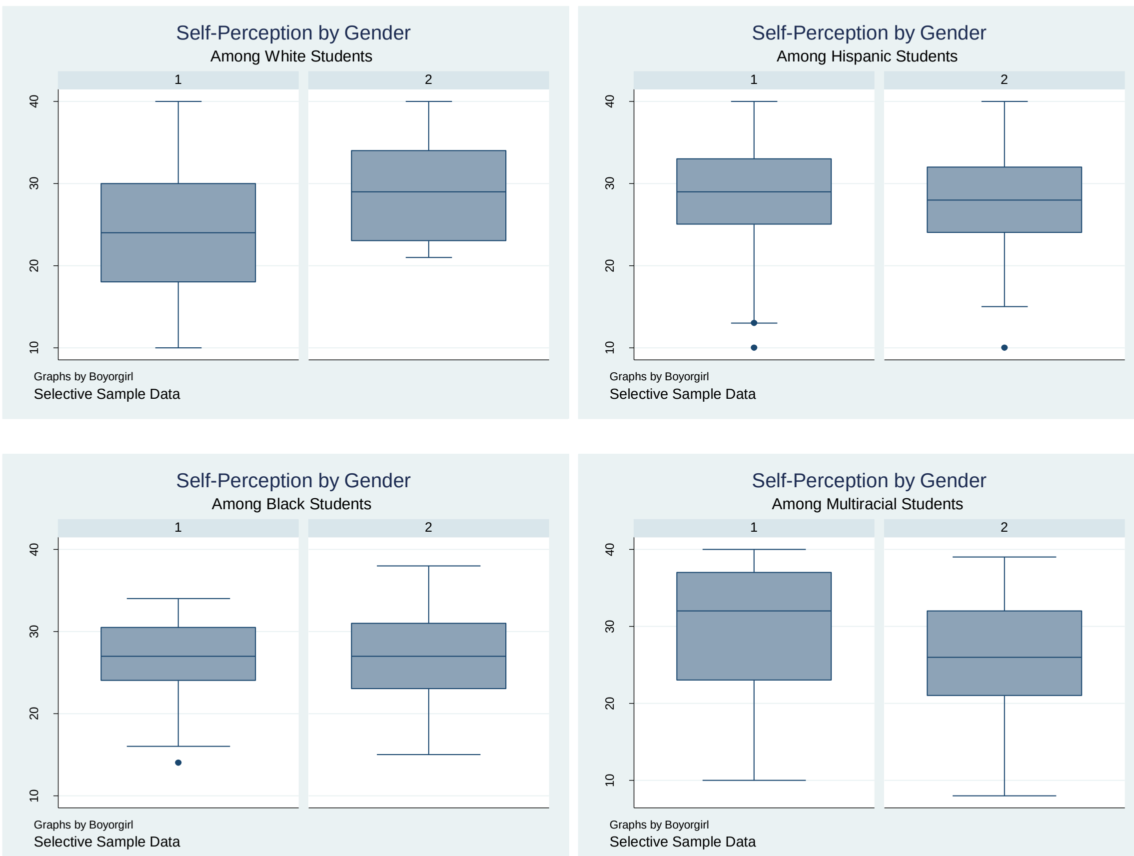


Table 8: Selective Sample Self-Perception Statistics by Ethnicity and Gender

Self-Perception	Boys			Girls		
	$\bar{x}$	s	n	$\bar{x}$	s	n
White Students	24.356	7.961	45	28.828	5.638	29
Hispanic Students	28.844	6.239	199	28.160	6.265	219
Black Students	26.050	6.074	20	27.467	6.323	15
Asian or Pacific Islander Students	25.000	5.273	11	20.524	7.068	21
Native American or Alaska Native Students	29.625	5.069	8	24.000	7.439	7
Multiracial Students	30.313	7.367	67	26.227	7.562	75

Figure 7 and Table 9 suggest a potential interaction present in enjoyment levels as well. Almost half of White boys scored lower than the minimum enjoyment score reported by White girls. Enjoyment levels between Hispanic and Multiracial boys and girls appear to be similar between both genders. There does appear to be an interaction present between gender and ethnicity impacting enjoyment, especially among White students.

Figure 7: Selective Sample Enjoyment by Gender and Ethnicity

Note That 1 Indicates Boys and 2 Indicates Girls

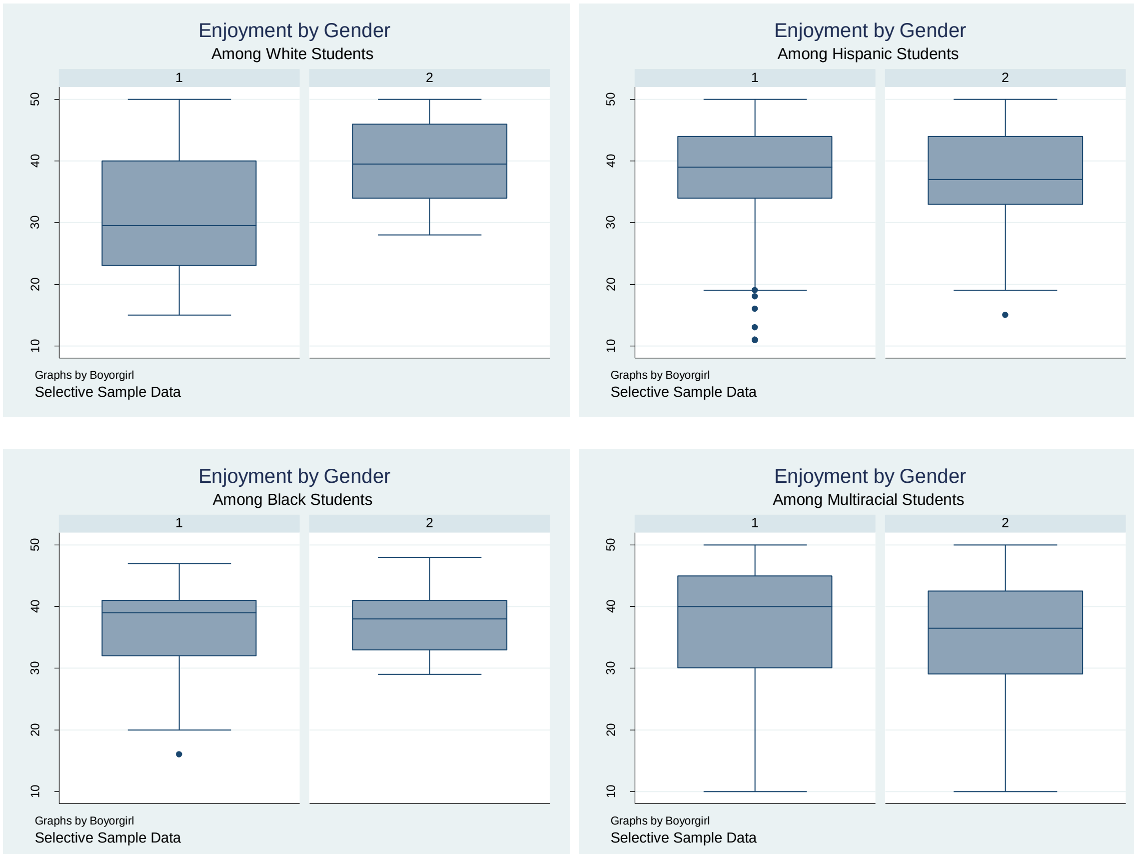


Table 9: Selective Sample Enjoyment Statistics by Ethnicity and Gender

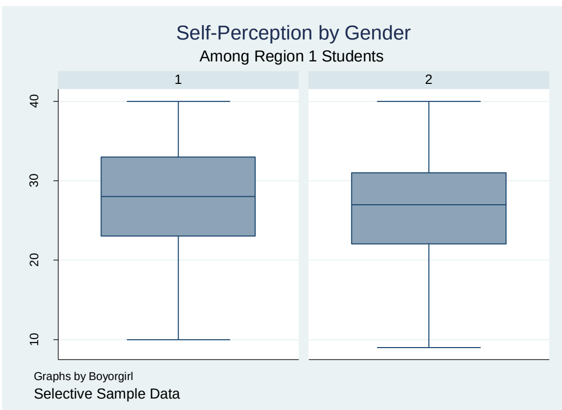
Enjoyment	Boys			Girls		
	$\bar{x}$	s	n	$\bar{x}$	s	n
White Students	30.159	9.793	44	39.600	7.156	30
Hispanic Students	37.528	8.636	197	37.733	7.323	217
Black Students	36.095	7.758	21	37.667	5.576	15
Asian or Pacific Islander Students	33.636	4.411	11	34.905	9.418	21
Native American or Alaska Native Students	39.625	10.094	8	34.857	5.699	7
Multiracial Students	36.754	10.136	65	35.211	9.768	76

Gender and Region

There is no reason to believe that gender and region have an interaction effect on either self-perception or enjoyment. See Figure 8 and Table 10. Boys seem to report higher self-perception in both regions and Region 2 students seem to report higher self-perception scores for both genders. Alternatively, the effects of gender on enjoyment level appear to be consistent across regions and enjoyment scores are higher in Region 2 for both genders as seen in Figure 9 and Table 11.

Figure 8: Selective Sample Self-Perception by Gender and Region

Note That 1 Indicate Boys and 2 Indicates Girls



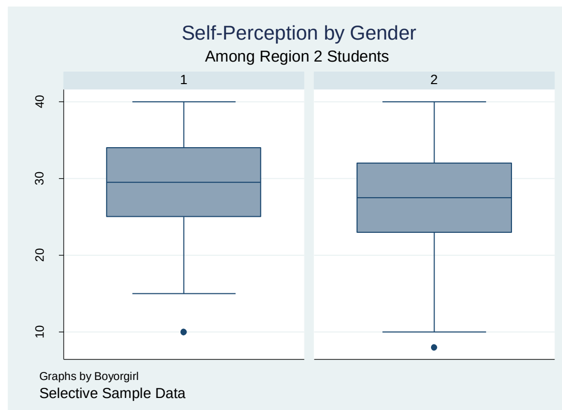


Table 10: Selective Sample Self-Perception Statistics by Region and Gender

Self-Perception	Boys			Girls		
	$\bar{x}$	s	n	$\bar{x}$	s	n
Region 1	27.505	7.162	186	26.820	6.828	183
Region 2	29.139	6.498	166	27.633	6.801	188

Figure 9: Selective Sample Enjoyment by Gender and Region

Note That 1 Indicates Boys and 2 Indicates Girls

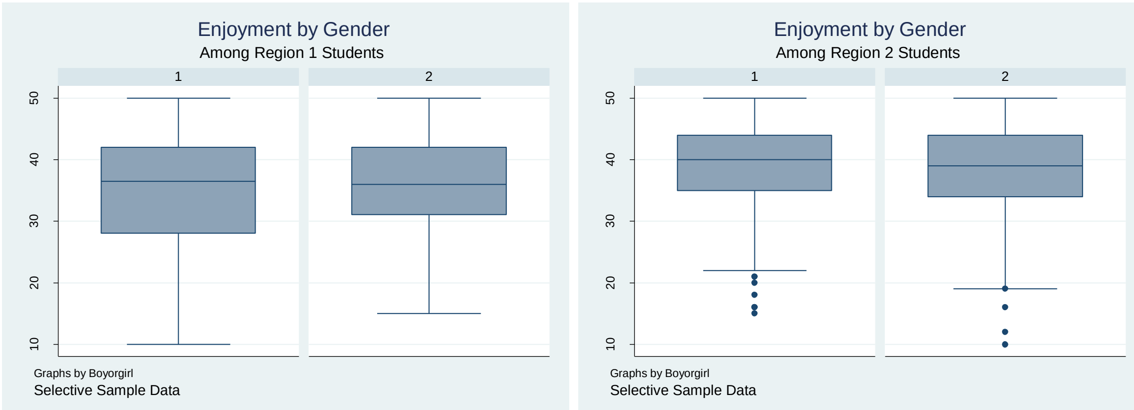


Table 11: Selective Sample Enjoyment Statistics by Region and Gender

Enjoyment	Boys			Girls		
	$\bar{x}$	s	n	$\bar{x}$	s	n
Region 1	34.435	9.965	186	35.978	8.162	183
Region 2	38.377	7.865	162	38.202	7.633	188

<u>Region and Ethnicity</u>

The *selective sample* data indicates that each ethnic group reacts to regional differences in different ways. With 41 responses from Region 1 and 33 responses from Region 2, White students report higher self-perception in Region 2. This is seen in Figure 10 and Table 12. Black students report higher self-perception in Region 1. There does not appear to be a significant difference in self-perception scores among Hispanic and Multiracial students by region.

Figure 10: Selective Sample Self-Perception by Region and Ethnicity

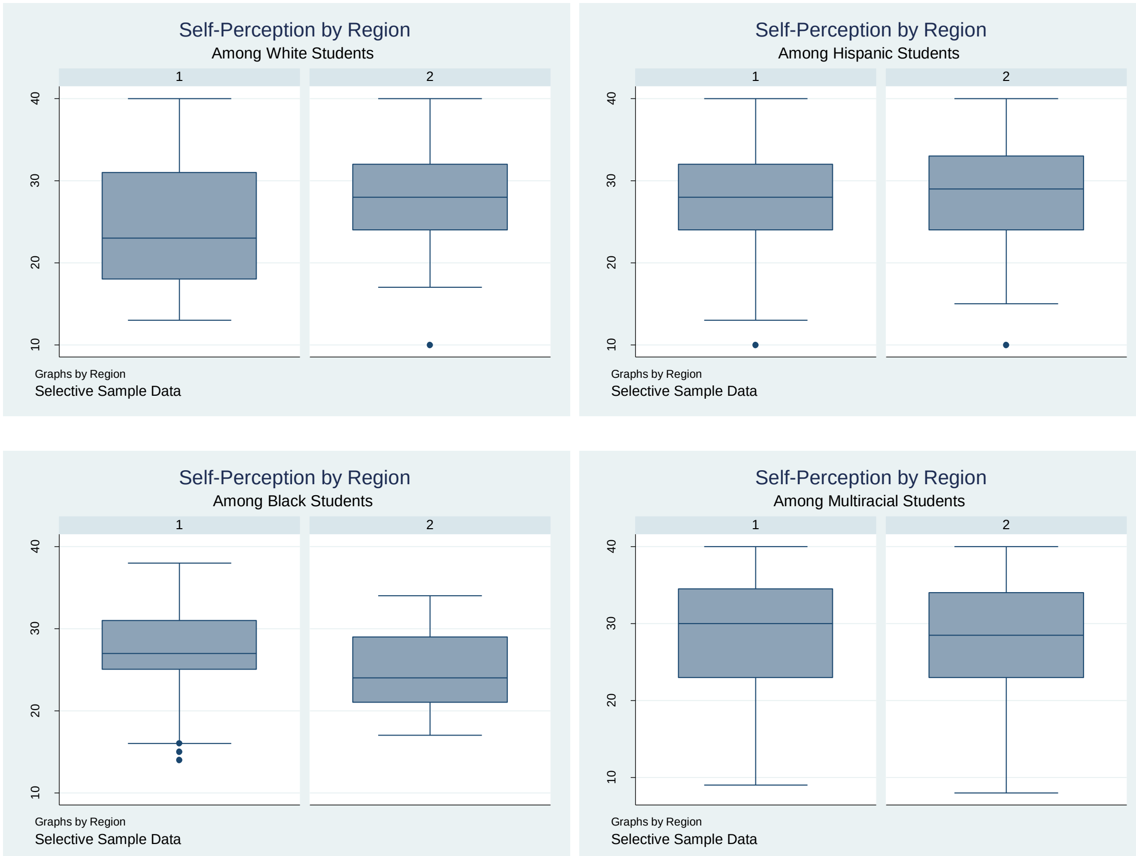


Table 12: Selective Sample Self-Perception Statistics by Ethnicity and Region

Self-Perception	Region 1			Region 2		
	$\bar{x}$	s	n	$\bar{x}$	s	n
White Students	24.171	7.665	41	28.515	6.462	33
Hispanic Students	28.238	5.931	181	28.672	6.484	238
Black Students	27.423	6.172	26	24.444	5.769	9
Asian or Pacific Islander Students	21.143	6.643	28	28.500	6.697	4
Native American or Alaska Native Students	26.000	6.819	9	28.500	6.863	6
Multiracial Students	28.452	7.792	84	27.724	7.664	58

There is also evidence that ethnicity and region may interact to have an impact on enjoyment, see Figure 11 and Table 13. There is not a clear difference in enjoyment level present between regions among Multiracial students. A difference is present among Hispanic students however, with the average enjoyment score differing from 35.811 in Region 1 to 39.047 in Region 2, where there is also a smaller standard deviation. White students show the most difference with an average enjoyment score of 30.333 in Region 1 and 38.781 in Region 2.

Figure 11: Selective Sample Enjoyment by Region and Ethnicity

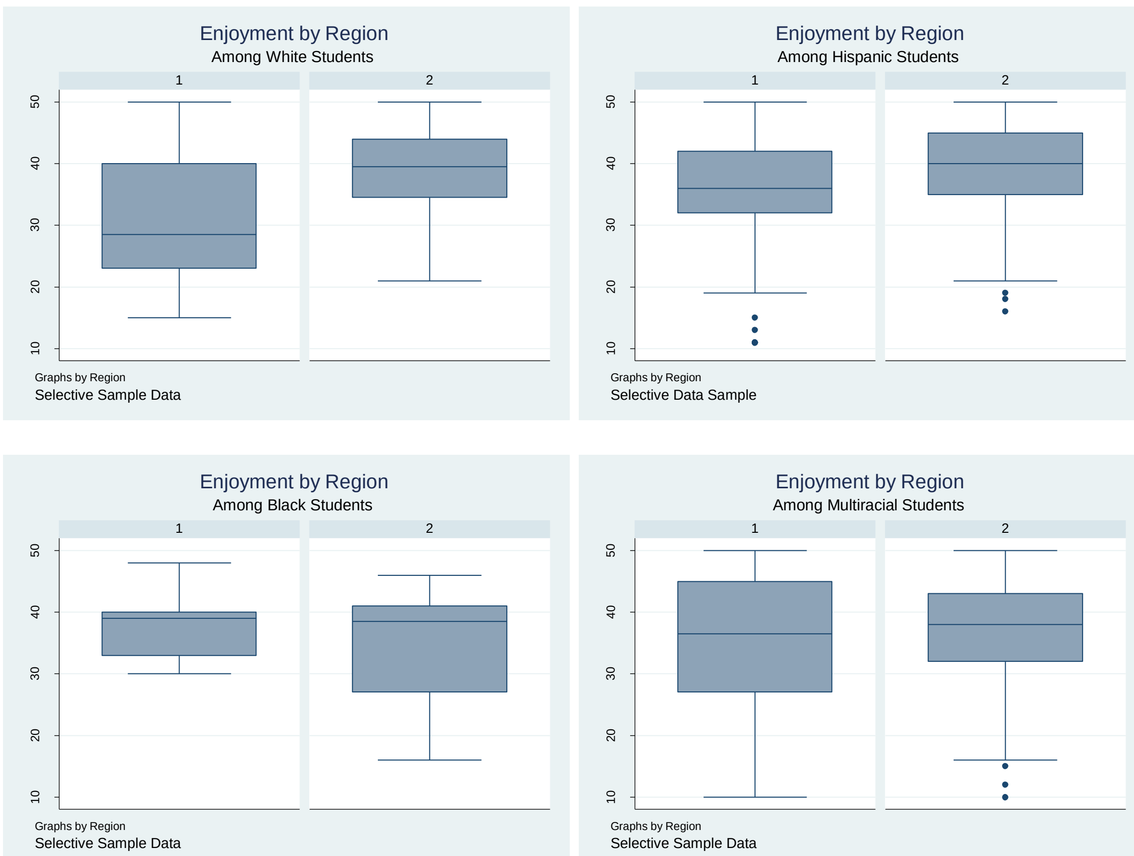


Table 13: Selective Sample Enjoyment Statistics by Ethnicity and Region

Enjoyment	Region 1			Region 2		
	$\bar{x}$	s	n	$\bar{x}$	s	n
White Students	30.333	10.144	42	38.781	7.369	32
Hispanic Students	35.811	8.723	180	39.047	7.020	235
Black Students	37.731	4.738	26	34.200	10.591	10
Asian or Pacific Islander Students	34.214	8.478	28	36.250	2.872	4
Native American or Alaska Native Students	37.778	5.495	9	36.833	12.222	6
Multiracial Students	35.595	10.299	84	36.404	9.439	57

Using the *selective sample* from Region 1, data exploration suggests that grade level has an impact on both self-perception and enjoyment of mathematics. The varying responses to changing grade level seen among the different ethnic groups suggests that ethnicity may be a significant factor as well. Differences in how ethnic groups are impacted by both gender and region suggest that there may be interactions between gender and ethnicity, and region and ethnicity. The strength of these claims will be explored further in the results chapter of this study. Single factors and interactions that should be considered for inclusion in the *selective sample* model are:

- Grade Level
- Gender
- Ethnicity
- Region
- Grade and Region
- Gender and Ethnicity
- Ethnicity and Region

The data set constructed using a *selective sample* from Region 1 was created to address bias. The *selective sample* was intended to ensure that differences found between the regions would be solely due to regional differences and not ethnic differences. However, doing this created a sample that is not representative of the true demographics of Region 1 which is why analysis was also conducted using a *random sample* from Region 1.

Random Sample

Grade

The data set formed using the *random sample* from Region 1 allows for conclusions made about region to be representative of the true demographics of Region 1. The data suggests that self-perception and enjoyment levels decrease in the sixth grade. See Figure 12 and Table 14. Fifth grade students show 51.24% reporting self-perception of at least 30 and an average of 29.208, while in the sixth grade that percentage falls to 43.26% with an average of 27.655. Enjoyment levels change from 50.25% of fifth grade students scoring at least 40 in the fifth grade to 39.06% of sixth grade students. The average enjoyment level falls as well from 38.265 in the fifth grade to 35.756 in the sixth grade. Sixth grade self-perception scores are higher in the *random sample* although the fifth grade scores are similar across samples. Similarly, the average enjoyment score among fifth grade students is higher in the *random sample* although the sixth grade scores are similar. This makes the drop in self-perception scores in the *random sample* less noticeable and the drop in enjoyment scores more obvious.

Figure 12: Random Sample Attitude by Grade

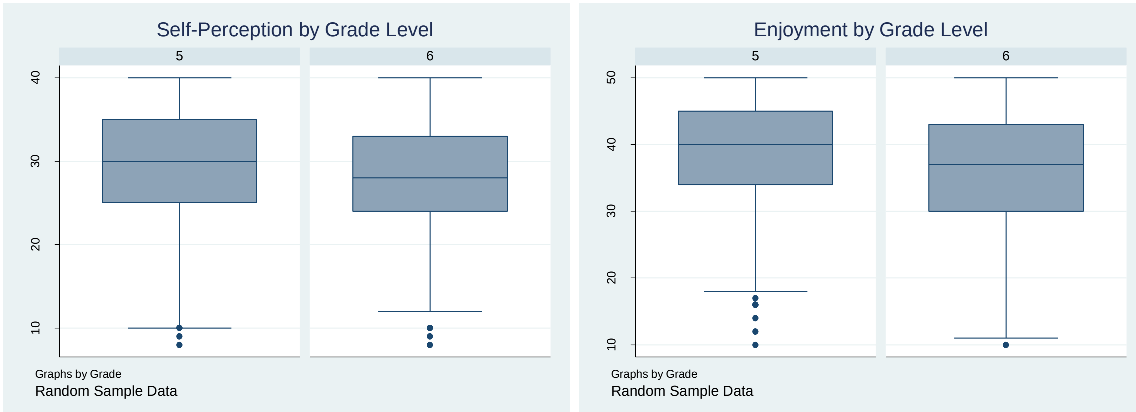


Table 14: Random Sample Attitude Statistics by Grade

	Self-Perception			Enjoyment		
	$\bar{x}$	s	n	$\bar{x}$	s	n
Fifth Grade	29.208	6.937	404	38.265	8.182	400
Sixth Grade	27.655	6.939	319	35.756	8.982	320

<u>Grade and Gender</u>

Data represented in Figure 13 and Table 15 both suggests that attitude falls with the transition from fifth grade to sixth grade among both genders as well. Fifth grade boys report 54.55% scoring at least 30 for self-perception while 44.23% of sixth grade boys did the same. Average self-perception score among boys drops 1.934 points upon entering the sixth grade. The change is less drastic among girls with 48.39% of fifth grade girls and 42.59% of sixth grade girls scoring at least 30 and a difference in averages of 1.268 points. Enjoyment scores among both genders fall as well as seen in Figure 13 and Table 15. Among boys, 51.37% of fifth graders and 35.90% of sixth graders reported enjoyment levels of at least 40. Enjoyment score average falls from 38.355 for boys in the fifth grade to 34.808 in the sixth grade. Among girls, 49.07% of fifth graders and 41.72% of sixth graders scored at least 40 for enjoyment level and a drop in average of 1.535. The data suggests that the transition to the sixth grade impacts boys more than girls.

Figure 13: Random Sample Attitude by Grade and Gender

Note That 1 Indicates Boys and 2 Indicates Girls

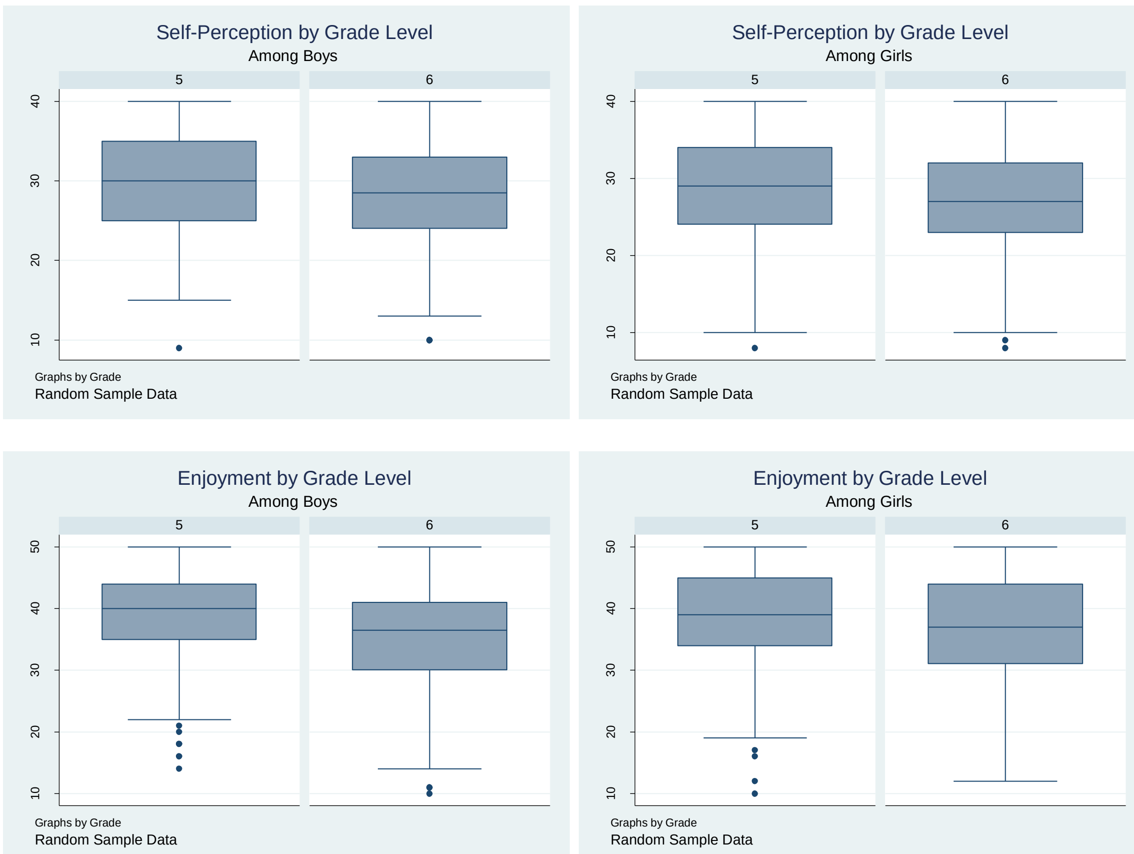


Table 15: Random Sample Attitude Statistics by Grade and Gender

		Self-Perception			Enjoyment		
		$\bar{x}$	s	n		s	n
Boys	Fifth Grade	30.005	6.415	187	38.355	8.058	183
	Sixth Grade	28.071	7.084	156	34.808	9.537	156
Girls	Fifth Grade	28.521	7.302	217	38.167	8.316	216
	Sixth Grade	27.253	6.816	162	36.632	8.369	163

Fifth and sixth grade boys reported higher self-perception scores in the *random sample* than in the *selective sample*. Enjoyment scores for fifth grade boys are higher in the *random sample* as well, however in this sample the average for sixth grade boys the average is lower making the drop in scores more prevalent. Self-perception scores for girls begin in a similar range in both samples but don't exhibit as much of a loss in the *random sample*. This decrease in enjoyment level among sixth grade girls is more prevalent in the *random sample* data because the average score for fifth grade girls is higher.

Grade and Ethnicity

Asian and Pacific Islander, and Native American and Alaska Native populations have significantly less representation than other ethnic groups limiting the strength of the claims that can be made for those groups. Consider Figure 14 and Table 16. The proportion of White students scoring at least 30 in self-perception drops from 53.33% in the fifth grade to 47.30% in the sixth grade. Their average scores fall from 29.547 in the fifth grade to 27.878 in the sixth grade while the standard deviation in each grade is similar. There is a slight drop in high self-perception scores among Hispanic students; 48.97% of fifth grade Hispanic students and 45.00% of sixth grade Hispanic students scored at least 30 in self-perception. The drop in average self-perception scores among Hispanic students is comparable to that of White students, with fifth graders reporting an average of 29.201 and sixth graders reporting an average of 27.664. The proportion of Black students scoring at least 30 on self-perception was 46.67% of fifth graders and 26.32% of sixth graders. Multiracial students respond to the transition to fifth-grade similarly to all other ethnic groups, with 55.45% of multiracial fifth-grade students and 46.58% of multiracial sixth-grade students reporting self-perception levels of at least 30. Multiracial students show the smallest drop in average self-perception scores, with fifth graders reporting an average of 29.071 and sixth graders reporting an average of 28.219.

The most noticeable differences between data sets can be found among White and Multiracial students; Hispanic students display similar trends in both data sets. White students in the fifth grade report similar average self-perception scores but the drop in the sixth grade is 3 points greater in the *selective sample*. Multiracial students exhibit the same drop across data sets but the averages are higher in the *random sample* data.

Figure 14: Random Sample Self-Perception by Grade and Ethnicity

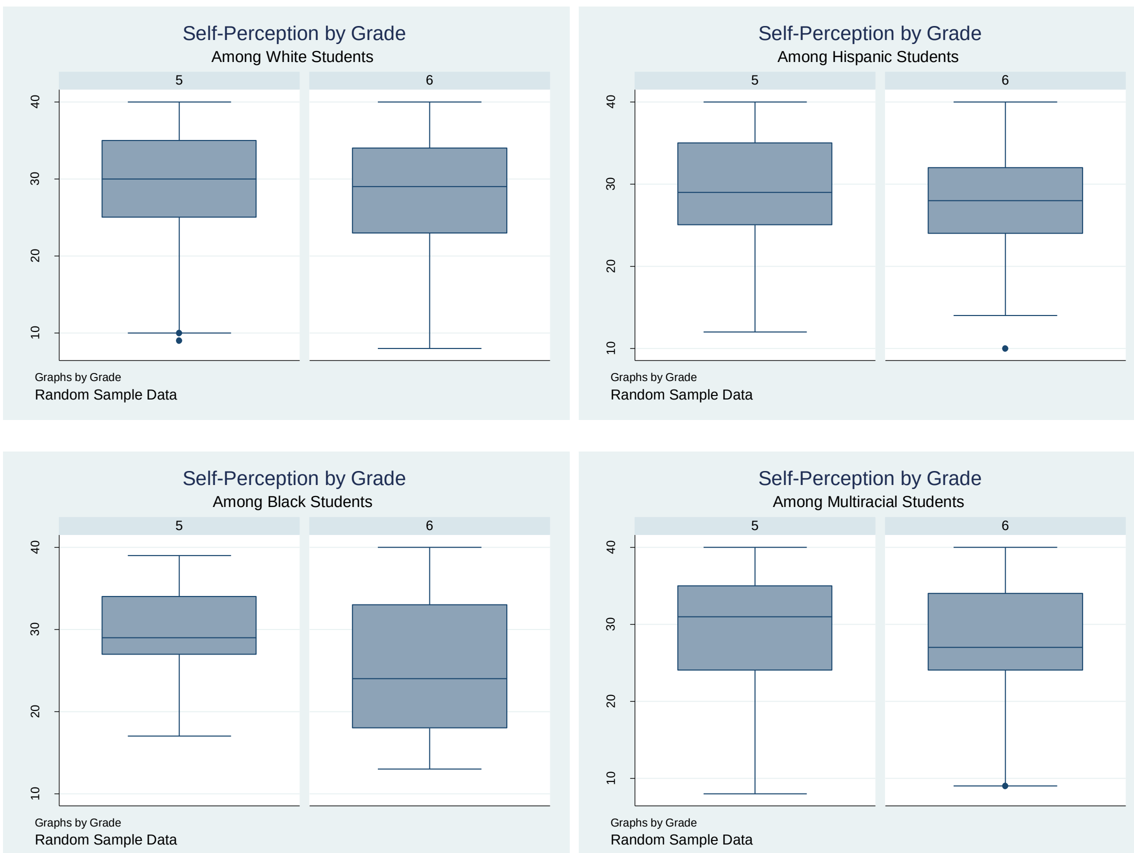


Table 16: Random Sample Self-Perception Statistics by Grade and Ethnicity

Self-Perception		$\bar{x}$	s	n
White	Fifth Grade	29.547	7.223	75
	Sixth Grade	27.878	7.909	74
Hispanic	Fifth Grade	29.201	6.496	194
	Sixth Grade	27.664	6.090	140
Black	Fifth Grade	29.133	6.174	15
	Sixth Grade	25.737	8.627	19
Asian and Pacific Islander	Fifth Grade	28.125	3.643	8
	Sixth Grade	27.286	5.765	7
Native American and Alaska Native	Fifth Grade	30.375	6.501	8
	Sixth Grade	25.600	5.983	5
Multiracial	Fifth Grade	29.071	7.882	99
	Sixth Grade	28.219	7.165	73

As seen in Figure 15 and Table 17, enjoyment is impacted more by the grade transition than self-perception among White students with 45.95% of fifth grade students and 32.43% of sixth grade students scoring at least 40 in enjoyment. Average enjoyment score among White students falls from 37.014 in the fifth grade to 33.000 in the sixth grade. A drop is seen among Hispanic students as well with 53.16% of fifth graders and 41.55% of sixth graders reporting enjoyment levels of at least 40 and a drop in average enjoyment level from 39.000 in the fifth grade to 37.254 in the sixth grade. Enjoyment is heavily impacted by changing grade levels among Black students with 70.59% of fifth grade students and 21.05% of sixth grade students scoring at least 40. Among multiracial students, 45.31% of fifth graders and 47.22% of sixth graders reported enjoyment levels of at least 40. Though the percentage of high enjoyment scores increases slightly in the sixth grade among multiracial students, the average score drops from 37.598 in the fifth grade to 36.111 in the sixth grade. Each ethnic group appears to respond to the transition from fifth grade to sixth grade differently.

Figure 15: Random Sample Enjoyment by Grade and Ethnicity

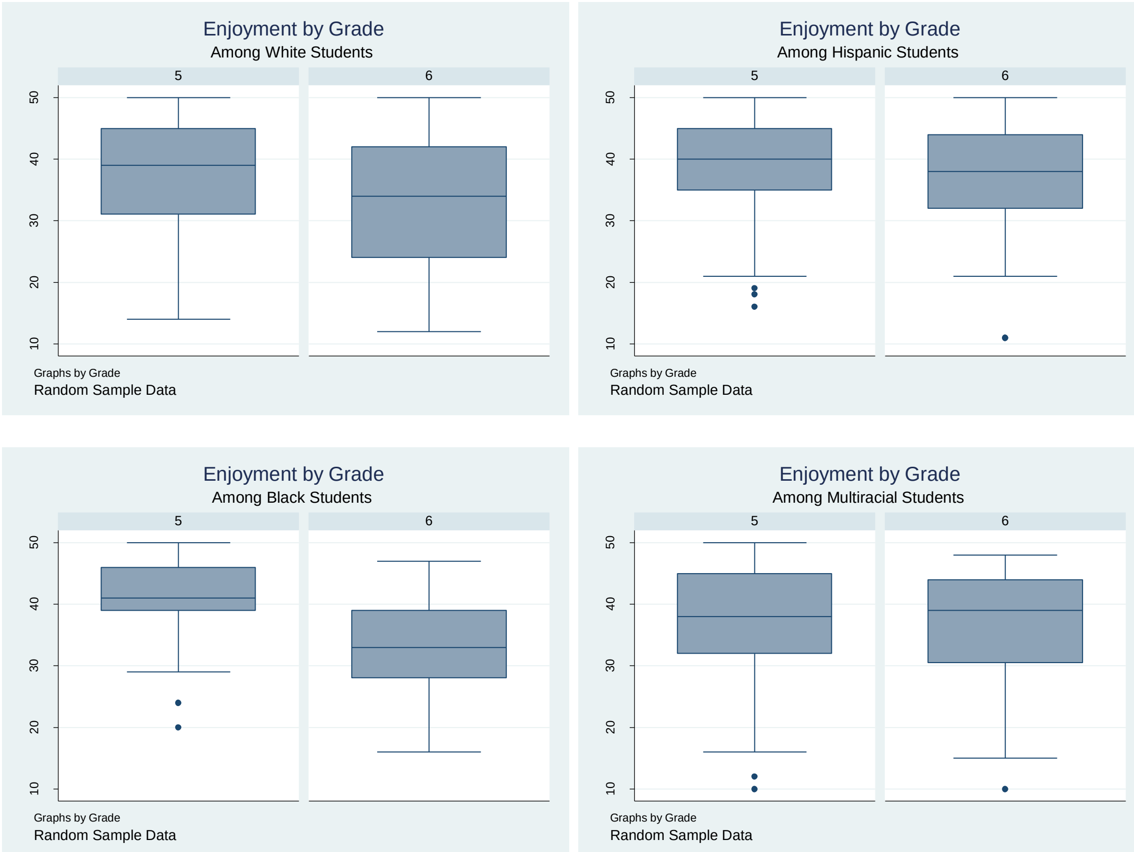


Table 17: Random Sample Enjoyment Statistics by Grade and Ethnicity

Enjoyment		$\bar{x}$	s	n
White	Fifth Grade	37.014	9.321	74
	Sixth Grade	33.000	10.366	74
Hispanic	Fifth Grade	39.000	7.131	190
	Sixth Grade	37.254	7.871	142
Black	Fifth Grade	39.824	8.353	17
	Sixth Grade	33.368	8.474	19
Asian and Pacific Islander	Fifth Grade	38.250	4.027	8
	Sixth Grade	36.857	5.928	7
Native American and Alaska Native	Fifth Grade	39.000	11.136	8
	Sixth Grade	38.200	5.630	5
Multiracial	Fifth Grade	37.598	9.203	97
	Sixth Grade	36.111	9.505	72

White, Hispanic and Multiracial student enjoyment levels vary between data sets. There is a greater difference present between the grade level averages of White students in the *selective sample* data set. The average enjoyment score for Hispanic fifth graders is higher in the *random sample* data set, but the average for Hispanic sixth grade students are similar. As is the case with self-perception scores, the difference between the average scores for both fifth and sixth grade Multiracial students is similar in both data sets, but the scores themselves are higher when the *random sample* is used.

<u>Grade and Region</u>

Figure 16 and Table 18 indicates that region impacts attitude in various ways as well. The proportion of Region 1 students scoring at least 30 for their mathematical self-perception is 53.26% of fifth graders and 45.95% for sixth graders. Among Region 2 students 49.55% of fifth grade students and 39.55% of sixth grade students reported self-perception levels of at least 30. Enjoyment does not follow the same trend in both regions. Within Region 1, 52.72% of fifth graders and 28.65% of sixth graders report enjoyment levels of at least 40. The average enjoyment score for fifth grade students in Region 1 is 38.457, falling to 33.676 in the sixth grade. There is no reason to believe that enjoyment levels decrease upon entering the sixth grade in Region 2 however. The proportion of students scoring at least 40 in enjoyment is 48.15% in the fifth grade and 53.33% in the sixth grade. Fifth grade students in Region 2 reported an average score of 38.102 which is similar to the average of 38.607 among sixth grade students in the region. The difference in the impact that grade level has on enjoyment levels between both regions suggests that there may be an interaction present between region and grade level effecting enjoyment.

Figure 16: Random Sample Attitude by Grade and Region

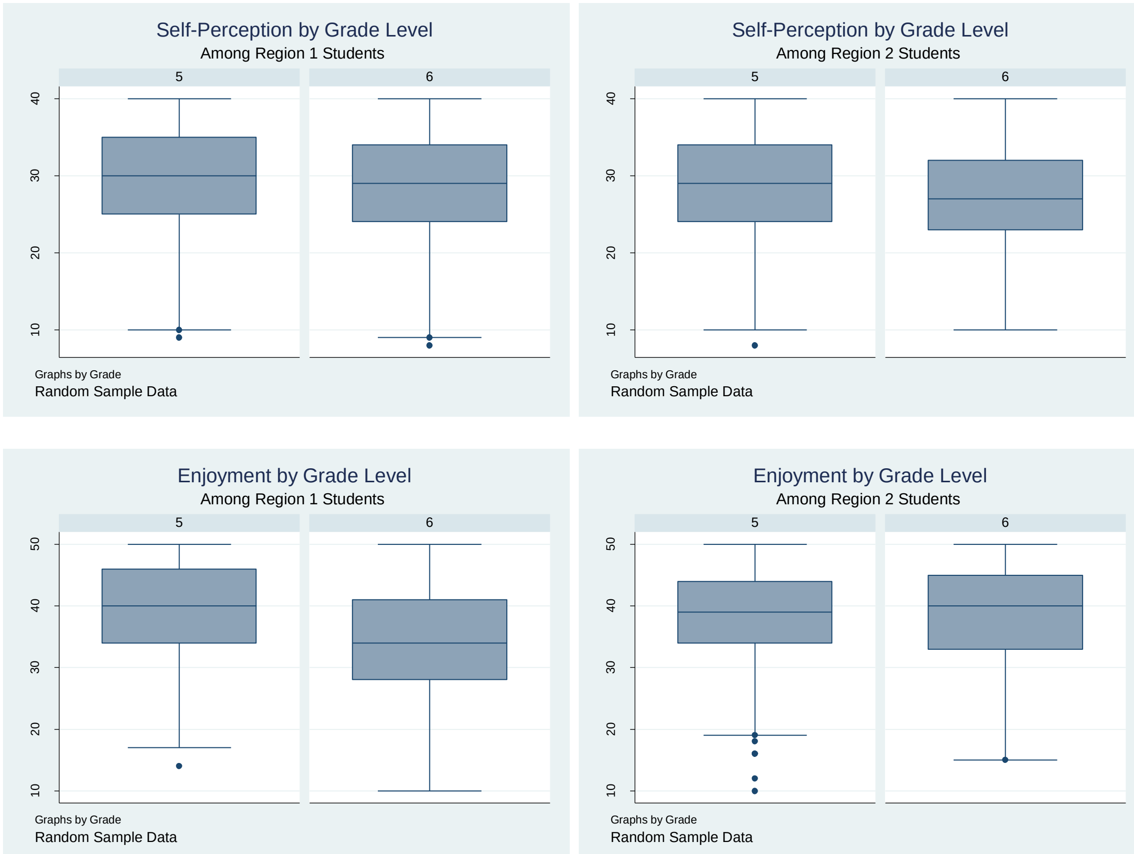


Table 18: Random Sample Attitude Statistics by Grade and Region

		Self-Perception			Enjoyment		
		$\bar{x}$	s	n	$\bar{x}$	s	n
Region 1	Fifth Grade	29.402	7.163	184	38.457	8.678	184
	Sixth Grade	28.000	7.270	185	33.676	9.296	185
Region 2	Fifth Grade	29.045	6.755	220	38.102	7.752	216
	Sixth Grade	27.179	6.451	134	38.607	7.697	135

Fifth grade students in Region 1 report similar self-perception scores in both data sets. Region 1 sixth grade students report higher self-perception scores in the *random sample*. When enjoyment scores are compared across samples, the difference in averages between grade levels in Region 1 is greater in the *random sample*. In the *random sample* data fifth grade students report higher enjoyment levels but sixth grade students report lower enjoyment levels.

Gender and Ethnicity

Descriptive analysis continues by investigating further potential interactions, beginning with looking at ethnicity and gender. The strongest conclusions can be drawn from White, Hispanic, and Multicultural students. Boys and girls appear to have similar distributions for both White and Hispanic students as seen in Figure 17 and Table 19. Multiracial boys seem to report slightly higher self-perception scores than Multiracial girls.

Figure 17: Random Sample Self-Perception by Gender and Ethnicity

Note That 1 Indicates Boys and 2 Indicates Girls

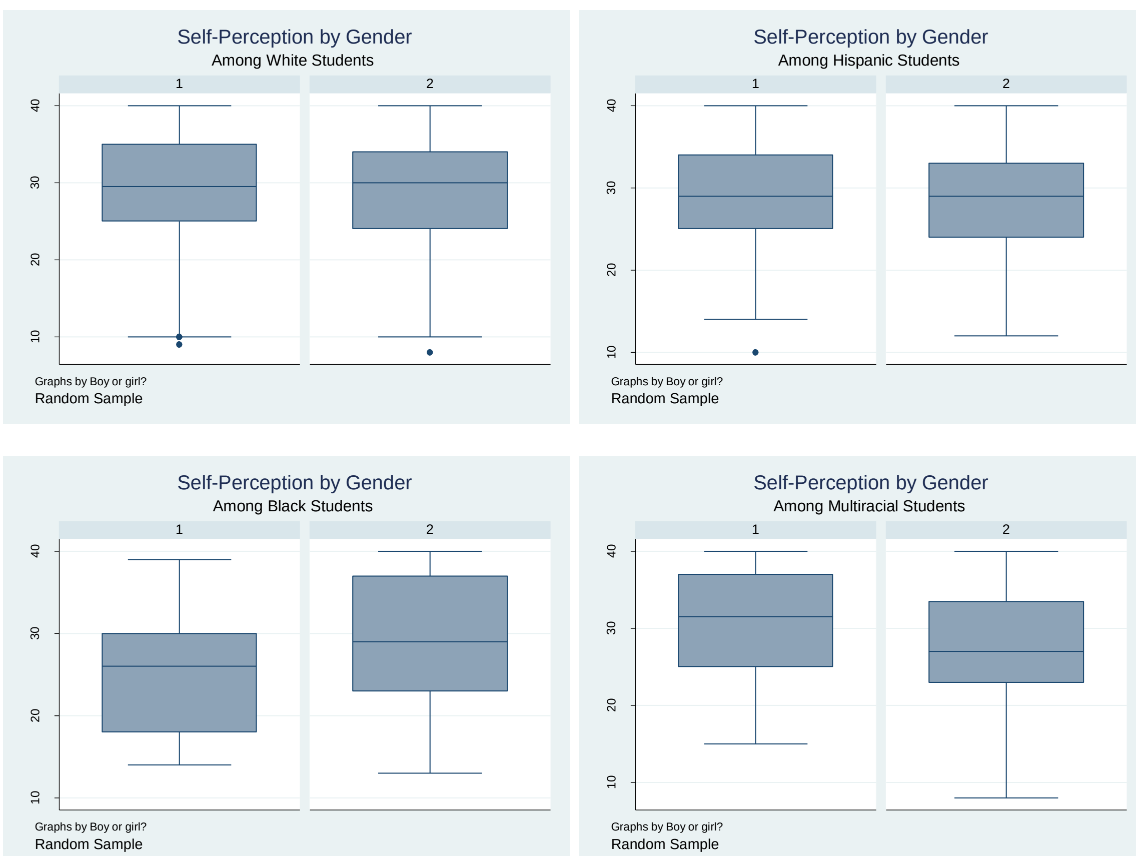


Table 19: Random Sample Self-Perception Statistics by Ethnicity and Gender

Self-Perception	Boys			Girls		
	$\bar{x}$	s	n	$\bar{x}$	s	n
White Students	28.829	7.887	70	28.620	7.370	79
Hispanic Students	28.981	6.225	159	28.172	6.502	174
Black Students	25.368	7.425	19	29.600	7.689	15
Asian or Pacific Islander Students	27.000	3.937	9	28.833	5.636	6
Native American or Alaska Native Students	30.625	5.125	8	25.200	7.662	5
Multiracial Students	30.803	6.625	76	27.052	7.899	96

White boys are more affected by the different sampling methods than any other group in examining the gender and ethnic interaction. White boys in the *random sample* report an average self-perception score that is 4.473 points lower than the average self-perception score for White boys when the *selective sample* is used. There were, however, significant sampling differences present with 45 White boys in the *selective sample* and 70 White boys in the *random sample*. Of the ethnic groups with significant population, the only other demographic that appears to be significantly affected by the sampling methods is Multiracial girls. The average self-perception for Multiracial girls is higher when the *random sample* is used.

Enjoyment levels seem to vary more by gender among ethnic groups. See Figure 18 and Table 20. Hispanic and Multiracial students report similar enjoyment levels between both boys and girls. White students show a different trend however. White girls report higher enjoyment levels than White boys. An interaction impacting enjoyment may be present between gender and ethnicity, with genders being impacted differently among certain ethnic groups.

Figure 18: Random Sample Enjoyment by Gender and Ethnicity

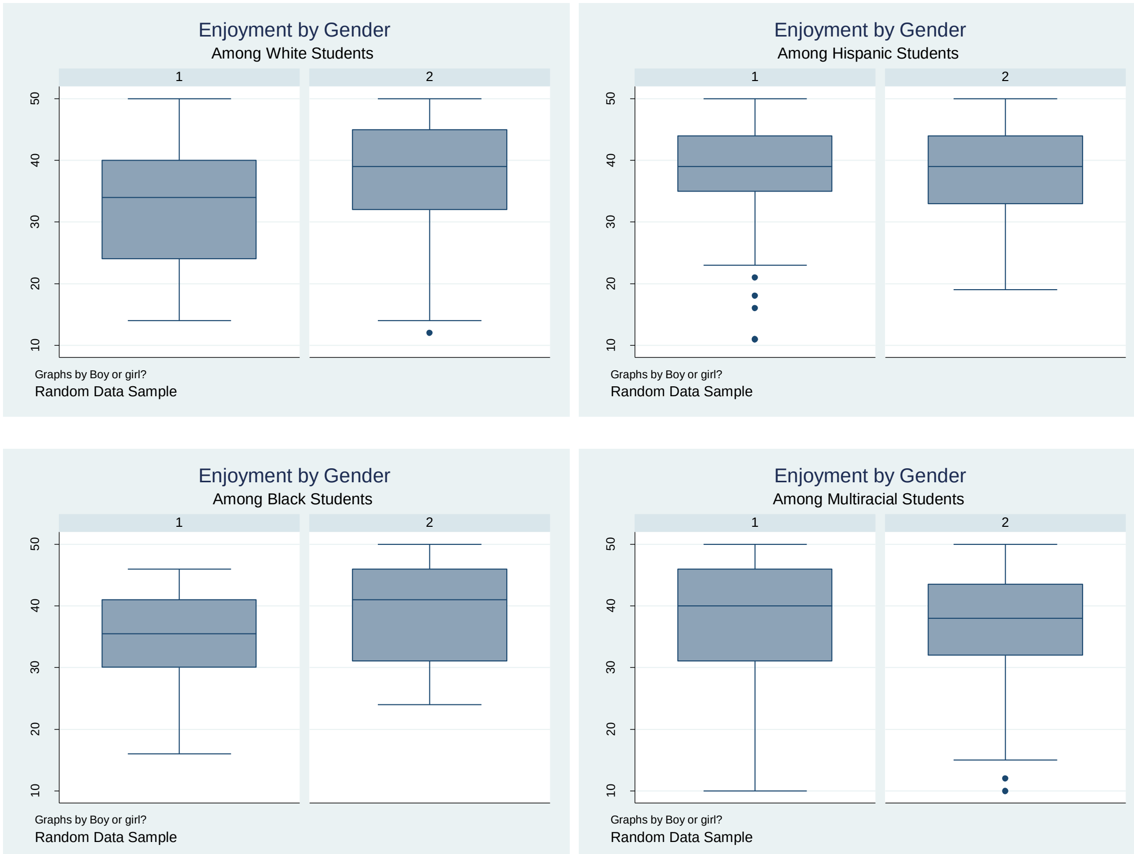


Table 20: Random Sample Enjoyment Statistics by Ethnicity and Gender

Enjoyment	Boys			Girls		
	$\bar{x}$	s	n	$\bar{x}$	s	n
White Students	32.159	10.010	69	37.494	9.420	79
Hispanic Students	38.348	7.466	158	38.150	7.560	173
Black Students	34.400	8.911	20	38.938	8.528	16
Asian or Pacific Islander Students	37.556	4.667	9	37.667	5.610	6
Native American or Alaska Native Students	40.500	10.379	8	35.800	6.611	5
Multiracial Students	37.712	9.652	73	36.396	9.095	96

The gender difference among White students is less prevalent in the *random sample* data. In this data set the average enjoyment score is 2.000 points higher for White boys and 2.106 points lower for White girls. While neither data set indicates a gender difference among Hispanic students, the enjoyment averages for Hispanic boys and girls are higher when the *random sample* is used. Multiracial boys and girls report higher enjoyment levels when the *random sample* is used as well. Multiracial students maintain the same approximate gender difference in both data sets.

<u>Gender and Region</u>

The data suggests that boys have higher self-perception of mathematical ability than girls in both regions, with the gender gap being more noticeable in Region 2 as seen in Figure 19 and Table 21. Figure 20 and Table 22 indicate that Region 1, girls report higher enjoyment scores than boys. In Region 2, however, there does not appear to be a difference in enjoyment level between genders. Self-perception and enjoyment averages across genders are greater in Region 1 in the *random sample*.

Figure 19: Random Sample Self-Perception by Gender and Region

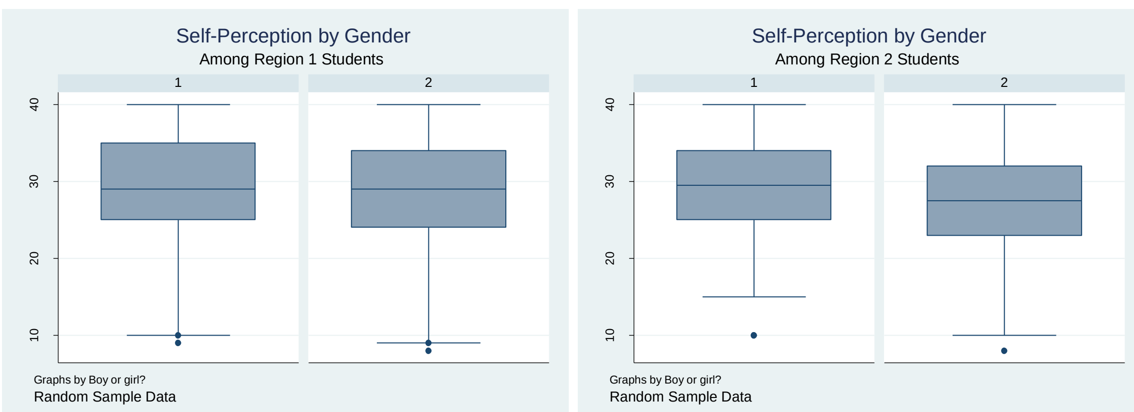


Table 21: Random Sample Self-Perception Statistics by Region and Gender

Self-Perception	Boys			Girls		
	$\bar{x}$	s	n	$\bar{x}$	s	n
Region 1	29.113	7.065	177	28.319	7.417	191
Region 2	29.139	6.498	166	27.633	6.801	188

Figure 20: Random Sample Enjoyment by Gender and Region

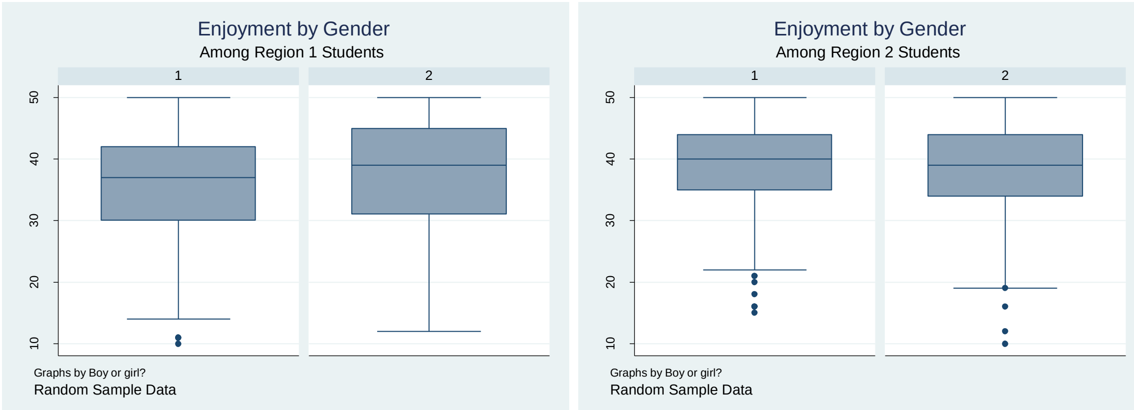


Table 22: Random Sample Enjoyment Statistics by Region and Gender

Enjoyment	Boys			Girls		
	$\bar{x}$	s	n	$\bar{x}$	s	n
Region 1	35.209	9.585	177	36.822	8.991	191
Region 2	38.377	7.865	162	38.202	7.633	188

<u>Ethnicity and Region</u>

Self-perception does not appear to be impacted by an interaction between region and ethnicity. See Figure 21 and Table 23. Self-perception distributions are similar between both regions among all ethnic groups.

Figure 21: Random Sample Self-Perception by Region and Ethnicity

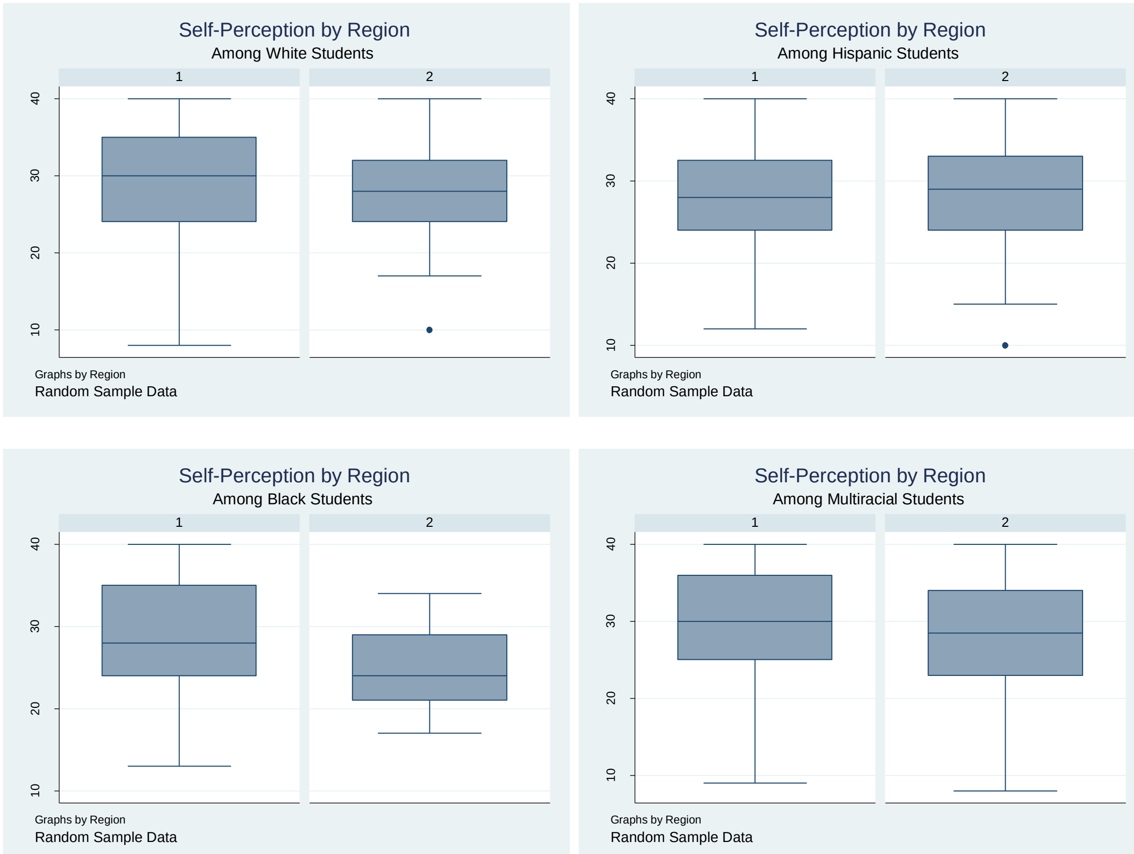


Table 23: Random Sample Self-Perception Statistics by Ethnicity and Region

Self-Perception	Region 1			Region 2		
	$\bar{x}$	s	n	$\bar{x}$	s	n
White Students	28.776	7.908	116	28.515	6.462	33
Hispanic Students	28.271	6.084	96	28.672	6.484	238
Black Students	28.240	8.187	25	24.444	5.769	9
Asian or Pacific Islander Students	27.455	5.007	11	28.500	3.697	4
Native American or Alaska Native Students	28.571	6.754	7	28.500	6.863	6
Multiracial Students	29.211	7.516	114	27.724	7.664	58

Figure 22 and Table 24 suggest there may be an interaction present between region and ethnicity impacting enjoyment levels. Multiracial students show similar enjoyment level distributions across both geographical regions and the difference in average enjoyment scores between regions is less than 1 point. White and Hispanic students both show slightly higher enjoyment levels in Region 2. White students in Region 1 report an average enjoyment level of 33.966 and a standard deviation of 10.433, whereas in Region 2 their average score in 38.781 and the standard deviation shrinks to 7.369. Hispanic students in Region 1 report an average enjoyment score of 36.330 and a standard deviation of 8.264. Region 2 Hispanic students report an average enjoyment level of 39.047 and a standard deviation of 7.020. White student's enjoyment levels appear to be impacted by region more than other ethnic groups.

Figure 22: Random Sample Enjoyment by Region and Ethnicity

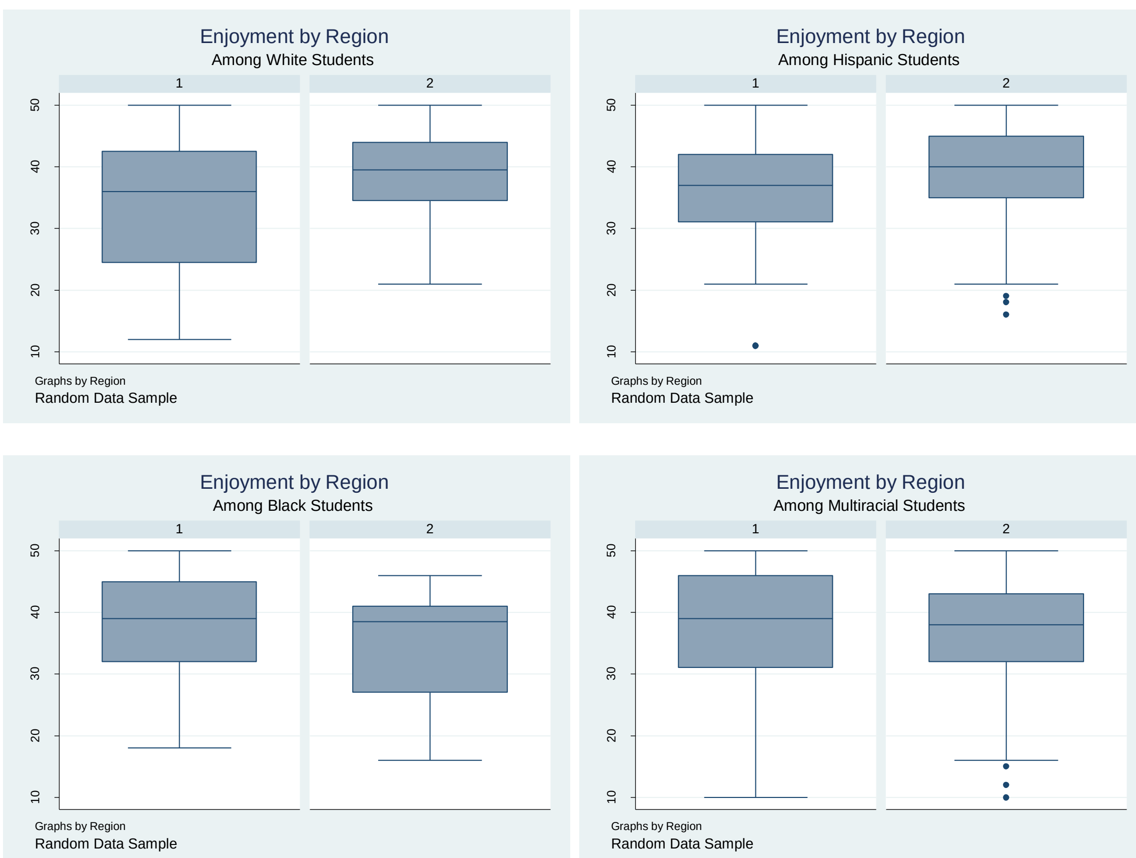


Table 24: Random Sample Enjoyment by Ethnicity and Region

Enjoyment	Region 1			Region 2		
	$\bar{x}$	s	n	$\bar{x}$	s	n
White Students	33.966	10.433	116	38.781	7.369	32
Hispanic Students	36.330	8.264	97	39.047	7.020	235
Black Students	37.269	8.259	26	34.200	10.591	10
Asian or Pacific Islander Students	38.091	5.449	11	36.250	2.872	4
Native American or Alaska Native Students	40.286	5.936	7	36.833	12.222	6
Multiracial Students	37.250	9.310	112	36.404	9.439	57

Of the ethnic groups with significant representation in Region 1, White students are the most affected but the different sampling methods. The average self-perception score for White students is 4.605 points higher when the *random sample* is used. In this sample, Multiracial students report higher self-perception as well but Hispanic student scores do not appear to be affected. The enjoyment levels of all ethnic groups vary across sampling methods. White, Hispanic, and Multiracial students in Region 1 all report higher enjoyment levels with the *random sample* is used. The greatest difference is found among White students.

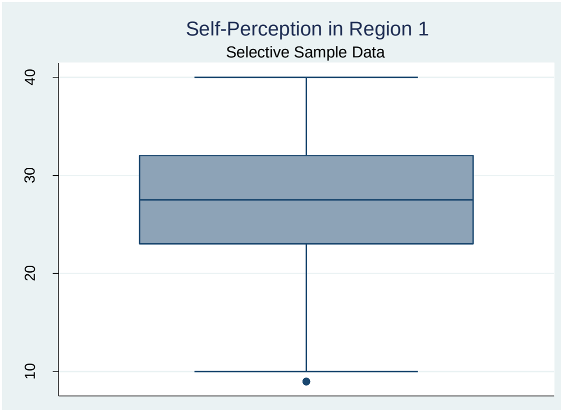
Analysis indicates that grade level is likely to have a significant impact on the mathematical attitude of students. The impact of grade level and ethnicity on enjoyment levels varies between regions. This indicates that there are likely interactions present between grade and region and ethnicity and region. The difference in enjoyment levels is not constant among the well represented ethnic groups, suggesting that there is an interaction present between gender and ethnicity. Main effects and interactions that should be considered for inclusion in the *random sample* model are:

- Grade level
- Gender
- Ethnicity
- Region
- Grade and Region
- Gender and Ethnicity
- Ethnicity and Region

<u>Sample Comparison</u>

Data collected using a *random sample* suggests the same potential significant factors as the data collected using a *selective sample*. The different sets display these potential differences with varying strengths. Analysis continues by exploring the differences between the sampling methods used. As indicated in Figures 23 and 24 and Tables 25 and 26, the selective sample results in lower mean self-perception and enjoyment scores. This suggests that student attitude towards mathematics is lower when only schools with predominately Hispanic populations are surveyed, which may indicate that student attitudes are stronger in more ethnically diverse schools. The data does not suggest that Hispanic students have lower self-perception or enjoyment levels than any other ethnic group, suggesting that the cause of the drop is not the increase of Hispanic students. Analysis has indicated that White student attitude towards mathematics is lower when the *selective sample* is used. The drop in attitude reported by White students is the cause of the overall decline in self-perception and enjoyment scores in the *selective sample*.

Figure 23: Region 1 Self-Perception by Sample



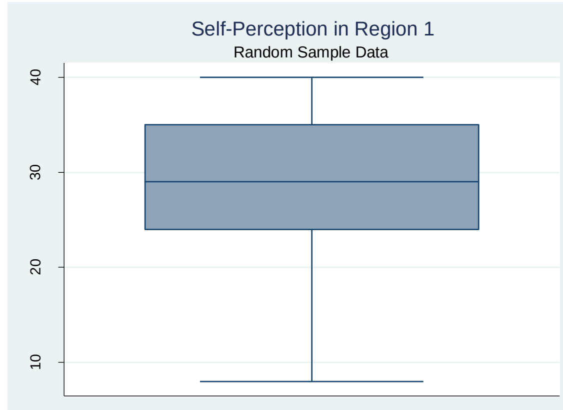
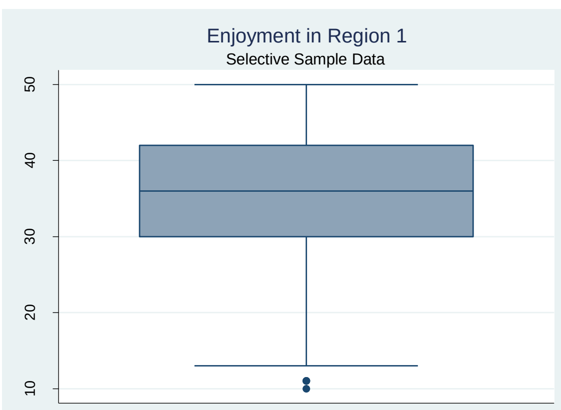


Table 25: Self-Perception Statistics in Region 1 by Sample

Self-Perception in Region 1	$\bar{x}$	s	n
Selective Sample	27.740	6.866	370
Random Sample	28.523	6.976	369

Figure 24: Region 1 Enjoyment by Sample



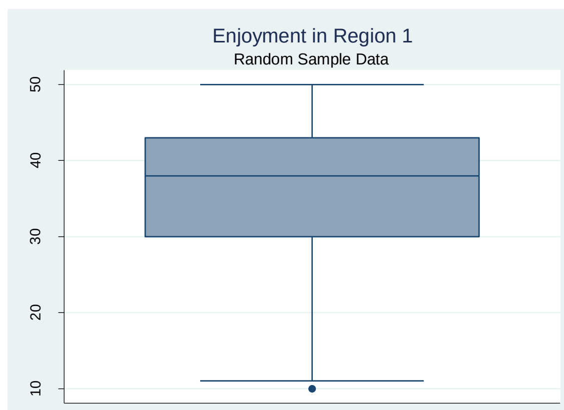


Table 26: Enjoyment Statistics in Region 1 by Sample

Enjoyment in Region 1	$\bar{x}$	s	n
Selective Sample	36.716	8.607	370
Random Sample	37.15	8.632	369

Grade Level

Self-perception scores in the fifth grade do not appear to be impacted by the different sampling methods. There are similar averages and distributions from both samples. Sixth grade students however, report a higher average self-perception in the *random sample*. As notes previously, the ethnic group that indicated the most difference between samples was White students. The self-perception average for sixth grade White students in the *selective sample* was 24.213, which is over 3 points lower than any other ethnic group with significant representation. These students are likely the cause of the difference in average seen between the samples.

Figure 25: Region 1 Self-Perception by Sample and Grade

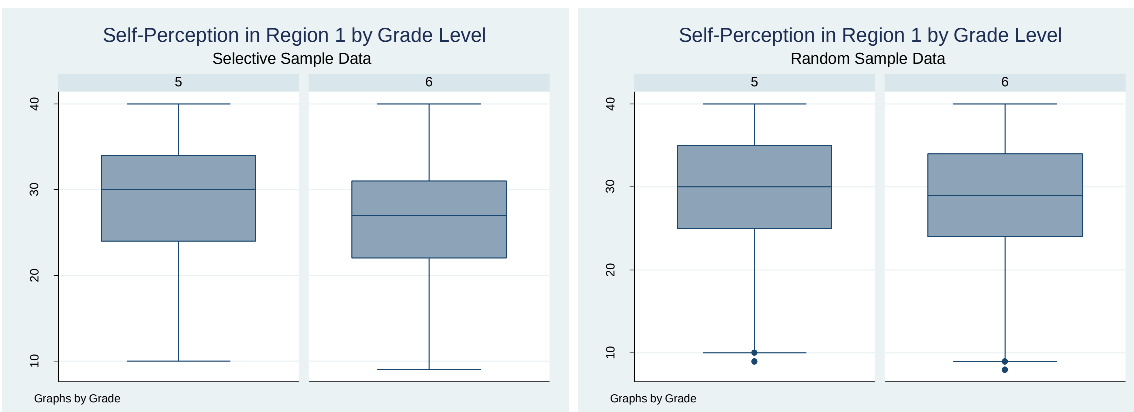


Table 27: Self-Perception Statistics in Region 1 by Sample and Grade

Self-Perception in Region 1	Fifth Grade			Sixth Grade		
	$\bar{x}$	s	n	$\bar{x}$	s	n
Selective Sample	29.043	6.616	117	26.300	6.997	253
Random Sample	29.402	7.163	184	28.000	7.270	185

As seen in Figure 26 and Table 28, apparent differences are present among enjoyment scores as well. The drop in enjoyment scores is more evident in the *random* *sample*, which demographically represents the region more accurately. The average self-perception scores start out slightly lower for fifth graders in the selective sample but do not exhibit as much of a fall upon entering the sixth grade. This is the opposite of what is seen among self-perception scores.

Figure 26: Region 1 Enjoyment by Sample and Grade

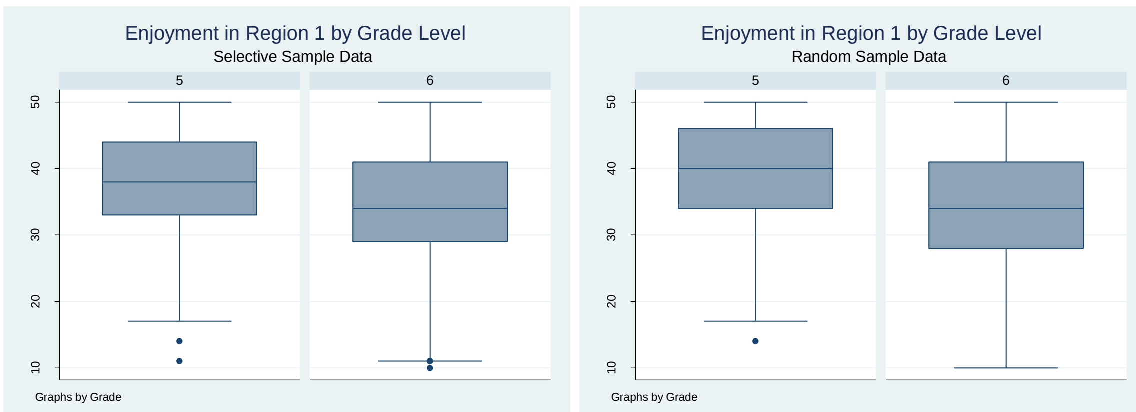


Table 28: Enjoyment Statistics in Region 1 by Sample and Grade

Enjoyment in Region 1	Fifth Grade			Sixth Grade		
	$\bar{x}$	s	n	$\bar{x}$	s	n
Selective Sample	37.470	8.546	117	34.174	9.217	253
Random Sample	38.457	8.678	184	33.676	9.296	185

<u>Gender</u>

Self-perception scores do not appear to be greatly affected among boys between the samples, although the random sample which better represents the demographics of Region 1 shows slightly higher averages in both grades. See Figure 27 and Table 29. Self-perception scores among girls are more affected by the different sampling methods. Girls from the random sample do not display much loss in their self-perception as they enter the sixth grade. Girls from the *selective sample* report higher scores on average in the fifth grade and lower scores in the sixth grade. This suggests that girls in schools with less diverse, heavier Hispanic populations may experience a greater loss in self-perception upon entering the sixth grade. The case is not the same for enjoyment levels.

Figure 27: Region 1 Self-Perception by Sample, Grade and Gender

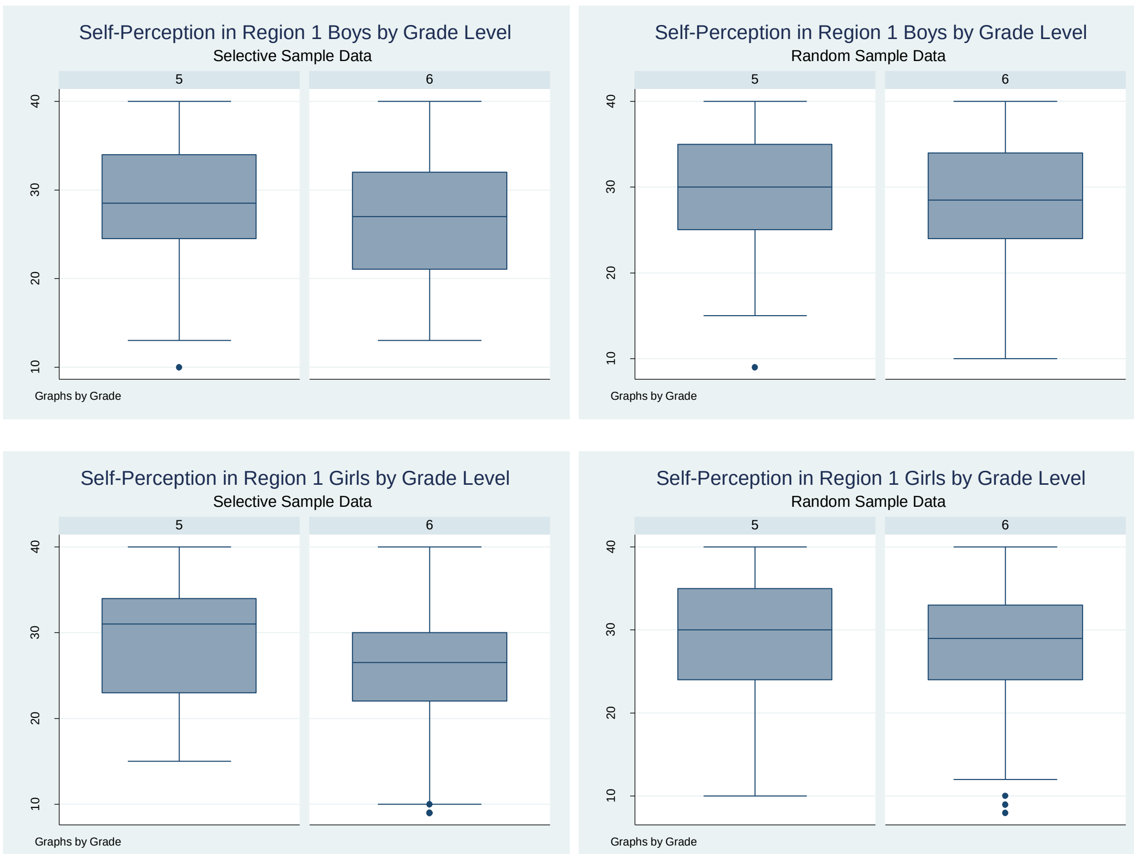


Table 29: Self-Perception Statistics in Region 1 by Sample, Grade and Gender

Self-Perception in Region 1		Fifth Grade			Sixth Grade		
		$\bar{x}$	s	n	$\bar{x}$	s	n
Boys	Selective Sample	28.929	6.492	56	26.892	7.371	130
	Random Sample	30.082	6.610	85	28.217	7.383	92
Girls	Selective Sample	29.148	6.779	61	25.656	6.575	122
	Random Sample	28.818	7.591	99	27.783	7.229	92

Figure 28 and Table 30 illustrate that in contrast to the trends seen in self-perception scores, girl's enjoyment levels appear to be unaltered by the different samples. Boys from the *random sample*, which is more ethnically diverse, exhibit the greatest loss in enjoyment scores. This suggests that the fall in enjoyment level among boys is less drastic in predominantly Hispanic populations.

Figure 28: Region 1 Enjoyment by Sample, Grade and Gender

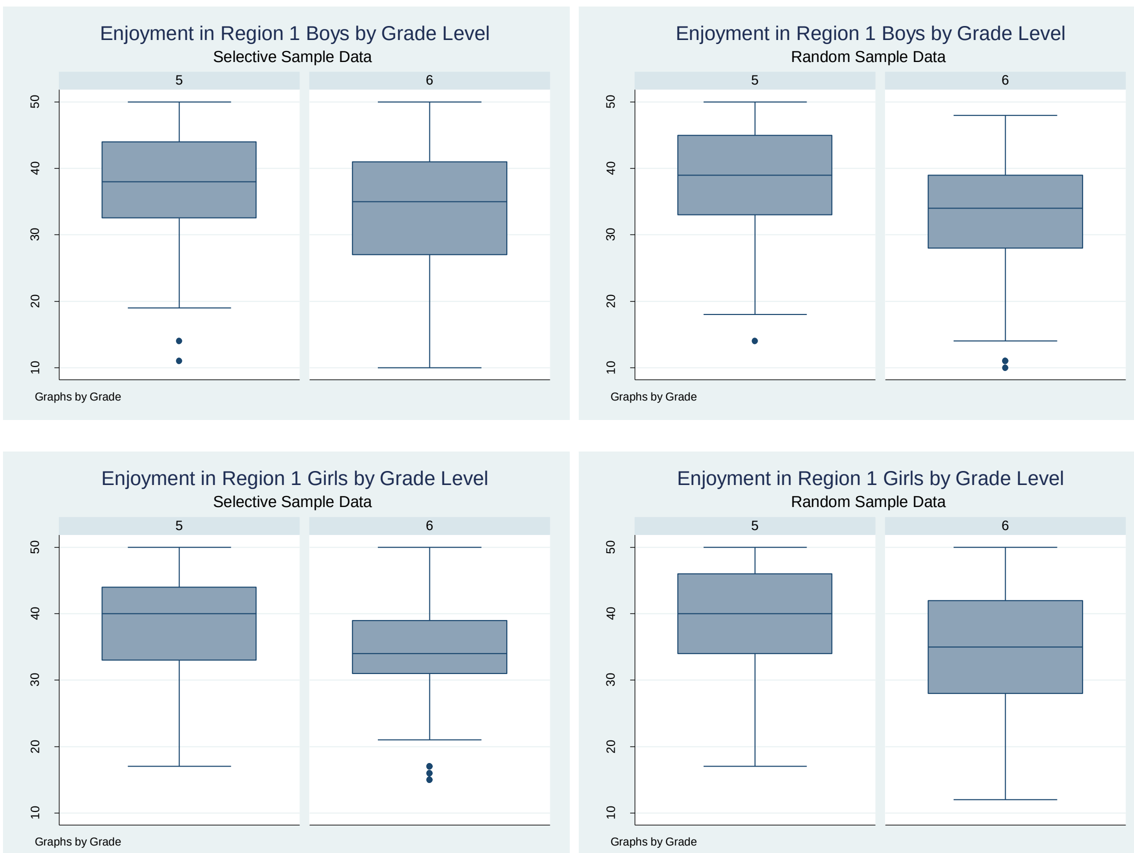


Table 30: Enjoyment Statistics in Region 1 by Sample, Grade and Gender

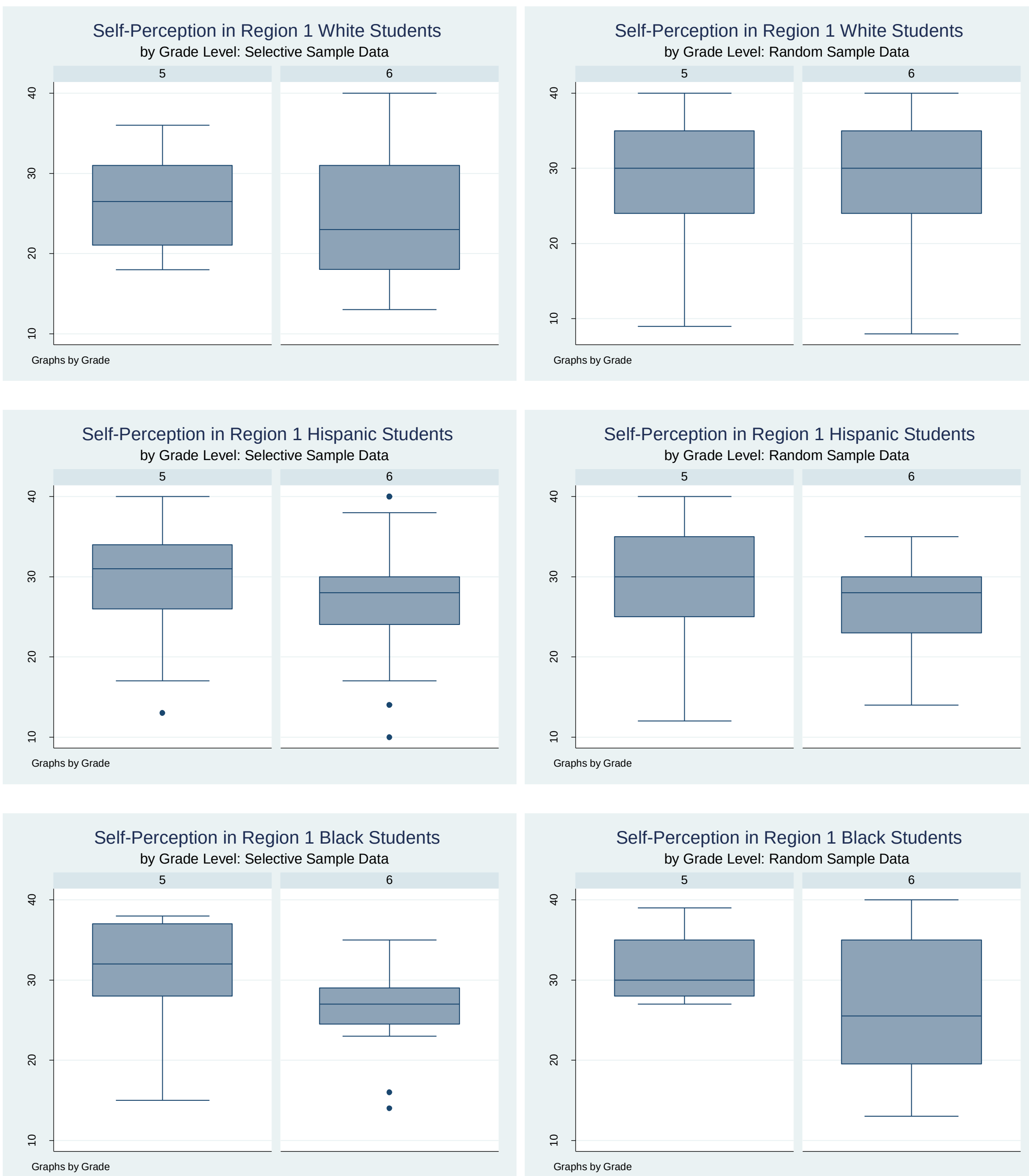
Enjoyment in Region 1		Fifth Grade			Sixth Grade		
		$\bar{x}$	s	n	$\bar{x}$	s	n
Boys	Selective Sample	36.536	9.485	56	33.531	10.065	130
	Random Sample	38.118	8.902	85	32.522	9.451	99
Girls	Selective Sample	38.328	7.560	61	34.803	8.228	122
	Random Sample	38.747	8.516	92	34.750	9.072	92

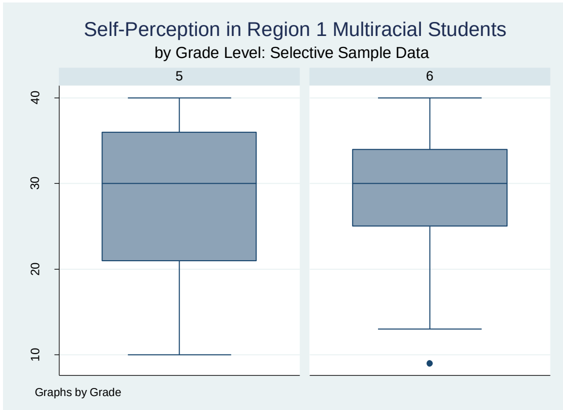
Ethnicity

Analysis indicates White students are the most impacted by different sampling methods. In both self-perception and enjoyment attitude levels among White students are negatively affected by the *selective sample* as seen in Figures 29 and 30 and Tables 31 and 32. White students in predominantly Hispanic schools reported lower self-perception and enjoyment scores and a larger difference in averages between grade levels in Region 1. A factor that may be influencing this is the sample size. There are only 42 White students represented in the selective sample, making up 11.20% of the students from Region 1. The *random sample* has 117 White students, representing 31.20% of Region 1 responses.

Hispanic student scores vary between samples as well. While in the fifth grade Hispanic self-perception scores are similar between the *selective sample* and the *random sample*, the self-perception scores of Hispanic sixth graders are lower when the *random sample* is used. Additionally, the difference between enjoyment scores by grade level is greater in the *random sample* data. Hispanic fifth graders in the *random sample* report an average enjoyment level 7.582 points higher than their sixth grade counterparts. The difference found in the *selective sample* data is 2.591 points. The only ethnic group that does not display a greater drop in enjoyment scores in the *random sample* is White students.

Figure 29: Region 1 Self-Perception by Sample, Grade and Ethnicity





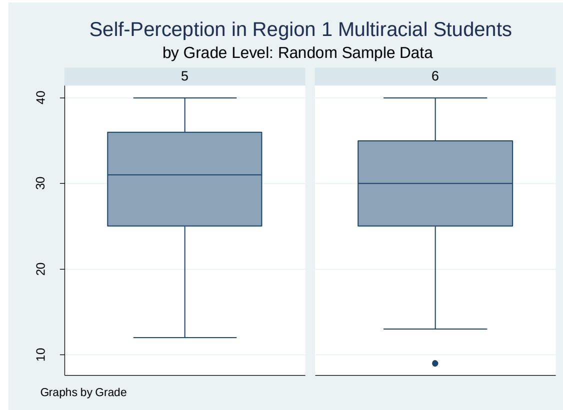
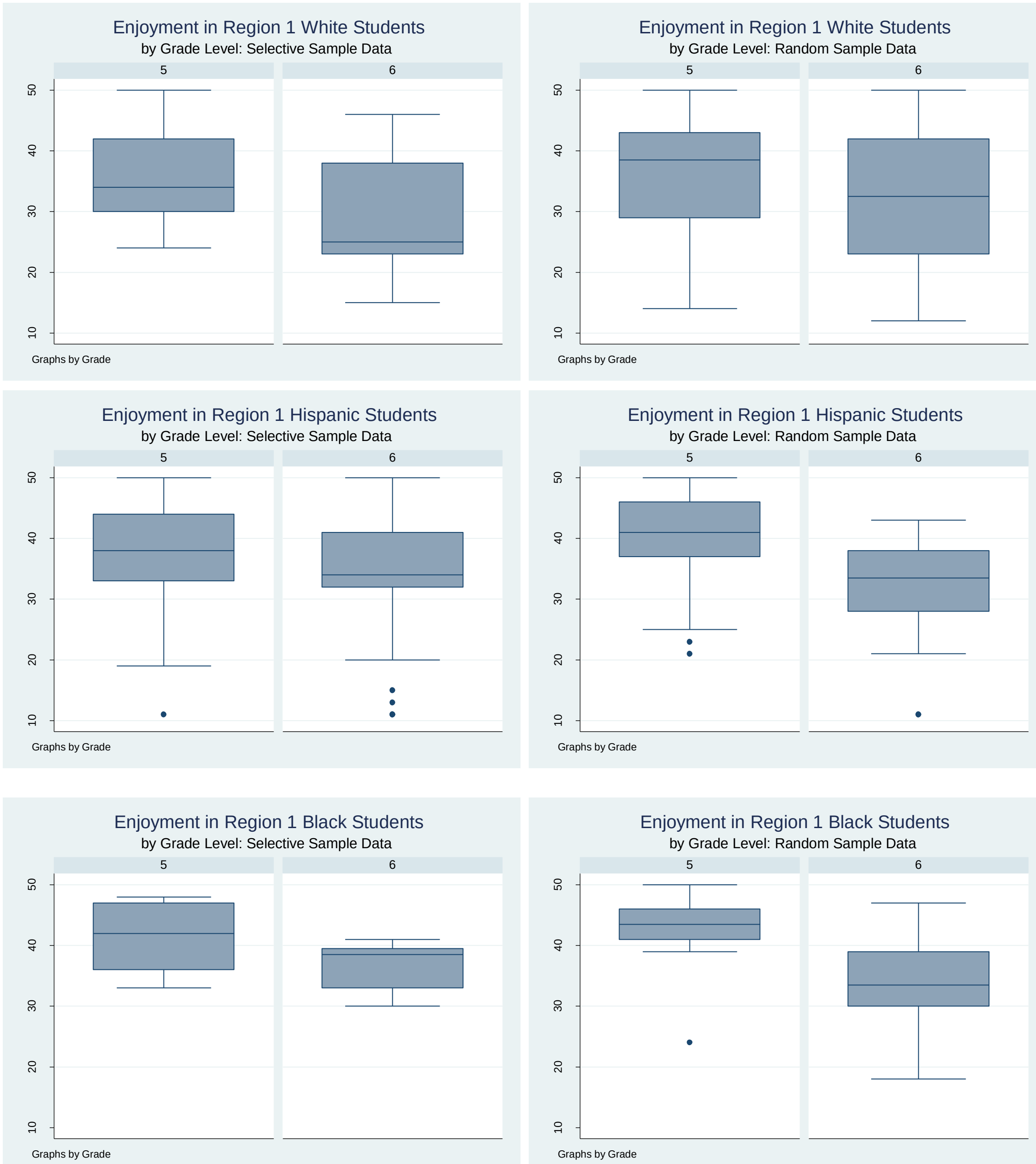
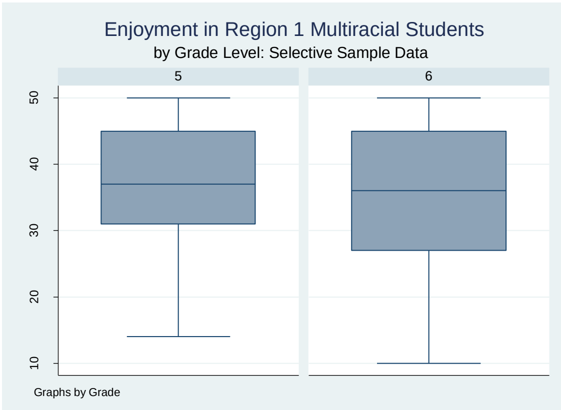


Table 31: Self-Perception Statistics in Region 1 by Sample, Grade and Ethnicity

Self-Perception in Region 1		Fifth Grade			Sixth Grade		
		$\bar{x}$	s	n	$\bar{x}$	s	n
White Students	Selective Sample	26.400	6.004	10	23.452	8.082	31
	Random Sample	29.069	7.581	58	28.482	8.279	58
Hispanic Students	Selective Sample	29.819	5.798	72	27.193	5.809	109
	Random Sample	29.551	6.611	49	26.936	5.223	47
Black Students	Selective Sample	30.333	8.454	6	26.550	5.276	20
	Random Sample	31.667	4.637	9	26.313	9.207	16
Asian and Pacific Islander Students	Selective Sample	26.000	4.082	4	20.333	6.696	24
	Random Sample	27.750	4.113	4	27.286	5.765	7
Native American and Alaska Native Students	Selective Sample	36.000	*	1	24.750	6.089	8
	Random Sample	33.667	2.087	3	24.750	6.551	4
Multiracial Students	Selective Sample	28.000	8.686	23	28.623	7.497	61
	Random Sample	29.164	7.813	61	29.264	7.233	53

Figure 30: Region 1 Enjoyment by Sample, Grade and Ethnicity





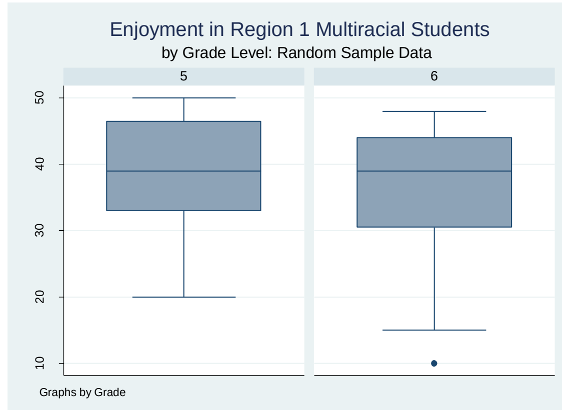


Table 32: Enjoyment Statistics in Region 1 by Sample and Grade, and Ethnicity

Enjoyment in Region 1		Fifth Grade			Sixth Grade		
		$\bar{x}$	s	n	$\bar{x}$	s	n
White Students	Selective Sample	36.545	8.116	11	28.129	9.976	31
	Random Sample	36.017	9.572	58	31.914	10.928	58
Hispanic Students	Selective Sample	37.380	8.461	71	34.789	8.777	109
	Random Sample	40.082	7.516	49	32.500	7.220	48
Black Students	Selective Sample	41.333	5.955	6	36.650	3.856	20
	Random Sample	42.300	7.364	10	34.125	7.329	16
Asian and Pacific Islander Students	Selective Sample	39.500	5.568	4	33.333	8.641	24
	Random Sample	40.250	4.349	4	36.857	5.928	7
Native American and Alaska Native Students	Selective Sample	47.000	*	1	36.625	4.565	8
	Random Sample	45.333	2.082	3	36.500	4.796	4
Multiracial Students	Selective Sample	36.261	10.177	23	35.344	10.418	61
	Random Sample	38.383	8.749	60	35.942	9.841	52

Summary

Table 2 is included below to aid in understanding of the differences between the samples. The *random sample* data is more telling of the attitude levels of students from Region 1 as a whole. The most variation across samples is found among White students, however they also experience a large loss in representation in the *selective sample*. When comparing the impact of the samples among the ethnic groups, the random sample results in a greater gap between grade levels for every ethnic group aside from White students. The sample where an ethnic group has more representation results in a smaller drop in attitude between grades. This is most likely due to sample size. Girls however, were well represented in both samples and analysis indicated that their self-perception scores were significantly lower in the *selective sample*.

Table 2: Sample Demographics

	Region 1 Selective Sample		Region 1 Random Sample		Region 2 Sample	
	Percentage	Number	Percentage	Number	Percentage	Number
White	11.20%	42	31.20%	117	8.80%	33
Hispanic	48.80%	183	25.87%	97	66.67%	250
African American	6.93%	26	6.93%	26	2.93%	11
Asian and Pacific Islander	7.47%	28	2.93%	11	1.07%	4
Native American and Alaska Native	2.40%	9	1.87%	7	1.60%	6
Multiracial	22.93%	86	30.40%	114	2.93%	60

CHAPTER V

ANALYSIS AND RESULTS

Similar to the data exploration, the statistical analysis of this data is broken into several parts, one for each sample data set. First the data set formed using the *selective sample* will be assessed, followed by analysis of the data set formed using the *random sample*. Within each section, analysis will begin with a MANOVA allowing for understanding of which factors and interactions effect overall attitude. Separate ANOVA models will then be developed to understand of how grade level, gender, ethnicity and region impact self-perception and enjoyment individually. Diagnostics run to assure data meets the necessary assumptions for these tests are included in the appendix. Post hoc testing display magnitude of the influence these factors and interactions have on enjoyment and self-perception of mathematics.

Selective Sample

MANOVA

The initial MANOVA in Table 33 below suggests that grade level is the only significant single factor (p=0.0003.) However, all other single factors are present in significant interactions and are therefore included in the model. Significant interactions are seen between gender and ethnicity (p=0.0028), region and ethnicity (p=0.0063), and grade and region (p=0.0199.) Assumptions verification is available in on pages 79-81 of the Appendix.

Table 33: Selective Sample MANOVA

MANOVA – Variable	**P-value**
Grade	0.0003
Gender	0.1095
Ethnicity	0.1098
Region	0.3987
Gender and Ethnicity Interaction	0.0028
Grade and Region Interaction	0.0063
Region and Ethnicity Interaction	0.0199

Analysis now examines the impact of the remaining effects individually on self-perception and enjoyment using Univariate Analysis of Variance (ANOVA). In order to have an overall type I error of 0.05 for both ANOVA models, each ANOVA will use a type I error of 0.025.

Self-Perception

The ANOVA shows grade level (p=0.0000) and ethnicity (p=0.0012), see Table 34. This suggests that there are the only significant single factors effecting self-perception. Gender is included in the model because its interaction with ethnicity is significant (p=0.0004). Exploration into potential interactions performed in the previous chapter agrees with this result. The earlier analysis suggested the greatest difference could be found between White and Multiracial students. Verification of ANOVA assumptions is available on pages 82-85 of the appendix.

Table 34: Selective Sample Self-Perception ANOVA

R^2=0.1083

Self-Perception ANOVA – Variable	**P-value**
Grade	0.0000
Gender	0.1211
Ethnicity	0.0012
Gender and Ethnicity Interaction	0.0004

Table 35 lists 95% confidence intervals of specific contrasts using the Tukey method. The intervals indicate a significant difference in self-perception by grade level. Fifth grade students are estimated to have an average self-perception score between 1.2 and 3.17 points higher than their sixth grade counterparts. Other significant differences can be seen between Hispanic boys and White boys, Multicultural boys and White boys, and Multicultural boys and Multicultural girls.

Table 35: Selective Sample Self-Perception Contrasts

Significant Self-Perception Contrasts	**95% Confidence Interval**
Sixth Grade – Fifth Grade	**(-3.170, -1.208)**
Ethnicity	
Hispanic – White	**(**-0.900, 4.106)
Black - White	(-2.483, 2.873)
Multiracial – White	(-1.245, 4.404)
Black - Hispanic	(-3.698, 0.883)
Multiracial - Hispanic	(-1.913, 1.866)
Multiracial - Black	(-1.065, 3.833)
Gender and Ethnicity Interaction	
Hispanic Boy – White Boy	**(0.321, 7.642)**
Black Boy – White Boy	(-1.521, 5.396)
Multiracial Boy – White Boy	**(1.637, 10.138)**
Black Boy – Hispanic Boy	(-5.080, 0.992)
Multiracial Boy – Hispanic Boy	(-1.205, 5.121)
Multiracial Boy – Black Boy	**(0.669, 7.230)**
Hispanic Girl – White Girl	(-5.144, 3.578)
Black Girl – White Girl	(-5.639, 2.545)
Multiracial Girl – White Girl	(-7.551, 2.094)
Black Girl – Hispanic Girl	(-4.205, 2.662)
Multiracial Girl – Hispanic Girl	(-4.903, 0.997)
Multiracial Girl – Black Girl	(-4.820, 2.457)
White Girl – White Boy	(-1.084, 9.428)
Hispanic Girl – Hispanic Boy	(-2.747, 1.577)
Black Girl – Black Boy	(-3.719, 5.093)
Multiracial Girl – Multiracial Boy	**(-8.161, -0.728)**

<u>Enjoyment</u>

The ANOVA model for enjoyment levels in the selective sample does not identify grade level as a significant main effect using an alpha of 0.025; however, grade level has p-value that is very close to significant and remains included in the model. See Table 36. The interactions between gender and ethnicity, and grade and region were both found to have significant impact on enjoyment. The interaction between region and ethnicity is not significant, however like grade level it’s p-value is close to significance and is therefore included in the final model. All factors are involved in significant interactions impacting enjoyment. Verification of ANOVA assumptions may be found on pages 88-90 of the appendix.

Table 36: Selective Sample Enjoyment ANOVA

R^2=0.1145

Enjoyment ANOVA – Variable	**P-value**
Grade	0.0298
Gender	0.8438
Ethnicity	0.5692
Region	0.8413
Gender and Ethnicity Interaction	0.0017
Grade and Region Interaction	0.0072
Region and Ethnicity Interaction	0.0302

Tukey contrasts shown in Table 37 identified several significant pairwise differences. In looking at the gender and ethnicity interaction, significant differences can be found between Hispanic boys and White boys, Multiracial boys and White boys, White girls and White boys and Hispanic girls and White boys. The interaction between grade and region indicates a significant difference in enjoyment levels between fifth and sixth grade students in Region 1. This was conjectured upon after exploring potential interactions in the previous chapter. Analysis continues to suggest that though grade level has an impact on student's mathematical enjoyment in Region 1, the enjoyment level of students in Region 2 remain unaffected.

Table 37: Selective Sample Enjoyment Contrasts

Significant Enjoyment Contrasts	**95% Confidence Interval**
Hispanic Boy – White Boy	**(1.281, 10.693)**
Black Boy – White Boy	**(0.413, 9.280)**
Multiracial Boy – White Boy	**(0.458, 11.639)**
Black Boy – Hispanic Boy	(-5.005, 2.724)
Multiracial Boy – Hispanic Boy	(-4.089, 4.212)
Multiracial Boy – Black Boy	(-3.040, 5.445)
Hispanic Girl – White Girl	(-7.553, 3.249)
Black Girl – White Girl	(-8.689, 2.182)
Multiracial Girl – White Girl	(-10.339, 1.618)
Black Girl – Hispanic Girl	(-5.796, 3.594)
Multiracial Girl – Hispanic Girl	(-5.916, 1.499)
Multiracial Girl – Black Girl	(-6.033, 3.818)
White Girl – White Boy	**(1.812, 15.034)**
Hispanic Girl – Hispanic Boy	(-2.115, 3.013)
Black Girl – Black Boy	(-5.226, 5.873)
Multiracial Girl – Multiracial Boy	(-6.852, 2.879)
Hispanic Girl – White Boy	**(1.613, 10.928)**
Grade and Region Interaction	
Sixth Grade Region 1 – Fifth Grade Region 1	**(-5.646, -0.774)**
Sixth Grade Region 2 – Fifth Grade Region 2	(-2.029, 2.694)

Random Sample

The MANOVA model formed using the *random sample* data suggests that grade level is the only significant main effect, shown in Table 38. The interactions between gender and ethnicity, and region and grade are significant as well. Using an alpha of 0.05, the interaction between region and ethnicity is not found to be significant, however with a p-value of 0.0911 it is still included in the final model. The p-values for most of main effects and interactions are higher in the *random sample* MANOVA than in the *selective sample* MANOVA. The one exception to this is the interaction between region and grade. Verification of the MANOVA assumptions is available on pages 96-99 of the appendix.

Table 38: Random Sample MANOVA

MANOVA – Variable	P-value
Grade	0.0028
Gender	0.5816
Ethnicity	0.6843
Region	0.5497
Gender and Ethnicity Interaction	0.0071
Region and Grade Interaction	0.0000
Region and Ethnicity Interaction	0.0911

Self-Perception

The self-perception ANOVA, shown in Table 39, continues to indicate that grade level has a significant main effect. Ethnicity, however, is no longer found to have a significant impact. Using a type I error of 0.025, the interaction between gender and ethnicity is no longer significant, however it's p-value is still quite low and remains in the model. Verification of the appropriate ANOVA assumptions is available on pages 100-102 of the appendix.

Table 39: Random Sample Self-Perception ANOVA

$R^2 = 0.0411$

Self-Perception ANOVA - Variables	P-value
Grade	0.0035
Gender	0.5230
Ethnicity	0.8601
Gender and Ethnicity Interaction	0.0443

Post hoc testing using pairwise contrasts by the Tukey method were then performed to identify specifically where significant differences occur. See Table 40. The test indicates with 95% confidence that the true difference in self-perception level by grade is between 0.506 and 2.555 points.

Table 40: Random Sample Self-Perception Contrasts

Significant Self-Perception Contrasts	95% Confidence Interval
Sixth Grade – Fifth Grade	**(-2.555, -0.506)**

Enjoyment

Grade level is the only significant main effect impacting enjoyment in this data set, as indicated in Table 40. Significant interactions can be found between gender and ethnicity, and region and grade. The interaction between region and ethnicity has a p-value of 0.0284 which is not significant with our alpha but remains included in the final model because it's p-value close to being a significant value. Verification of the appropriate ANOVA assumptions is available on pages 106-108 of the appendix.

Table 41: Random Sample Enjoyment ANOVA

R^2=0.1099

Enjoyment ANOVA – Variables	**P-values**
Grade	0.0008
Gender	0.8332
Ethnicity	0.7121
Region	0.8228
Gender and Ethnicity Interaction	0.0158
Region and Grade Interaction	0.0001
Region and Ethnicity Interaction	0.0284

Random sample enjoyment contrasts identify with 95% confidence that fifth grade students enjoy mathematics more than sixth grade students by between 0.892 and 3.383 points. See. Table 42. The gender and ethnicity interaction identified a significant difference between White students by gender with girls reporting higher enjoyment levels than boys by between 0.661 and 9.875 points. There is a significant difference between fifth and sixth grade students in Region 1 as well, with the true difference most likely being fifth grade students scoring between 2.390 and 6.873 points higher.

Table 42: Random Sample Enjoyment Contrasts

Significant Enjoyment Contrasts	**95% Confidence Interval**
Sixth Grade – Fifth Grade	**(-3.383, -0.892)**
Gender and Ethnicity Interaction	
Hispanic Boy – White Boy	(-0.234, 8.430)
Black Boy – White Boy	**(0.578, 7.643)**
Multiracial Boy – White Boy	(-1.389, 8.708)
Black Boy – Hispanic Boy	(-2.035, 5.161)
Multiracial Boy – Hispanic Boy	(-4.634, 3.758)
Multiracial Boy – Black Boy	(-4.265, 2.827)
Hispanic Girl – White Girl	(-5.625, 2.807)
Black Girl – White Girl	(-10.050, 1.955)
Multiracial Girl – White Girl	(-7.157, 2.029)
Black Girl – Hispanic Girl	(-9.555, 1.177)
Multiracial Girl – Hispanic Girl	(-4.792, 2.481)
Multiracial Girl – Black Girl	(-3.953, 7.455)
White Girl – White Boy	**(0.661, 9.875)**
Hispanic Girl – Hispanic Boy	(-3.305, 2.829)
Black Girl – Black Boy	(-9.070, 3.259)
Multiracial Girl – Multiracial Boy	(-5.367, 3.456)
Grade and Region Interaction	
Sixth Grade Region 1 – Fifth Grade Region 1	**(-6.873, -2.390)**
Sixth Grade Region 2 – Fifth Grade Region 2	(-2.017, 2.728)

CHAPTER VI

CONCLUSION

Understanding student attitude towards mathematics is a pivotal step in improving the educational process. Mathematics and other STEM fields are increasingly important as the world continues to grow in technological advancement, making knowledge and understanding in these areas a valuable skill. The data indicates that grade level has a significant impact on student attitude towards mathematics. The transition from fifth grade to sixth grade has a negative impact on student attitude towards mathematics. With few exceptions, self-perception and enjoyment scores for sixth grade students are lower than for fifth grade students across gender, ethnicities and regions.

Gender, ethnicity and region each impact student attitude as well. While grade level is the only factor that influences self-perception and enjoyment on its own, gender, ethnicity, and region are all present in significant interactions. Inferential statistics point to a significant interaction between gender and ethnicity impacting self-perception and enjoyment. Both data sets indicated that White students were the only ethnic group with a significant difference in enjoyment scores by gender. Enjoyment levels are significantly higher for White girls than for White boys. The attitude of White students is impacted by the diversity of their population as well. In the *selective sample* targeting schools with heavy Hispanic populations, White boys reported significantly lower self-perception and enjoyment levels than Hispanic and Multiracial boys. This difference was not found among girls. There is one other significant gender difference present in the data. The data set formed using a selective sample of Region 1 students indicated that Multiracial girls have higher self-perception of their mathematical abilities than Multiracial boys. Gender is not present in any other significant interactions.

Ethnicity is associated with changes in mathematical attitude further. Multivariate analysis suggests that there is a significant interaction effect present between ethnicity and region impacting mathematical attitude of students. White students are the most affected by region. The *selective sample* suggests that White students in Region 1 have lower mathematical attitude than White students in Region 2. The *random sample* indicates that region has no impact on self-perception but among White students was higher in Region 1. Analysis suggests that mathematical attitude of Hispanic students is influenced by region as well. Self-perception scores among Hispanic students are similar in both regions but the data suggests that enjoyment scores among Hispanic students are greater in Region 2. The mathematical attitude of Multiracial students is not influenced by regional differences present in the data.

Multivariate analysis indicates that region is associated with mathematical attitude of students in further ways. There is a significant interaction effect present between region and grade level. Fifth grade students in Region 1 report higher enjoyment levels than sixth graders in Region 1 in both data sets used. Analysis failed to identify a difference in enjoyment levels between fifth and sixth grade students in Region 2.

This study is subject to several limitations. Many ethnic groups are underrepresented and increasing sample size would broaden the current understanding of ethnic impact on mathematical attitude. The percentage of Multiracial students present in the study is much higher than that which is presented by each district. If the survey asked which ethnicity each participant most identifies with, ethnic groups would have greater representation. There were only two regions studied in this research. To make stronger inferences on the effects of region further surveys would need to be conducted involving multiple urban areas and rural areas with varying ethnic distributions. Originally school structure was intended to be a factor analyzed as well, however structure and region proved to be related effects with one region primarily separating fifth and sixth grade on different campuses and the other having both grades on the same campus.

Addressing a decline in student attitude towards mathematics is a pivotal step in improving achievement and longevity in the field. By understanding the factors impacting student attitude, we pave the way for further research to investigate strategies to maintain and improve student self-perception and enjoyment.

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APPENDIX

MATH AND ME SURVEY

MATH and Me Survey

Please circle ONE response for each question. Be sure to answer ALL the questions. Remember that there are no "right" or "wrong" answers. These are about how *you* feel about math. You do not have to write your name on this survey.

SD = strongly disagree **D** = disagree **N** = neither agree nor disagree **A** = agree **SA** = strongly agree

Statement	*How I Feel*				
1. I am really good at math.	SD	D	N	A	SA
2. I love math.	SD	D	N	A	SA
3. I understand math.	SD	D	N	A	SA
4. Math is boring.	SD	D	N	A	SA
5. I can solve difficult math problems.	SD	D	N	A	SA
6. I enjoy doing math puzzles.	SD	D	N	A	SA
7. Math is very hard for me.	SD	D	N	A	SA
8. I do math problems on my own "just for fun."	SD	D	N	A	SA
9. Math is confusing to me.	SD	D	N	A	SA
10. Math is fun.	SD	D	N	A	SA
11. I look forward to learning new math.	SD	D	N	A	SA
12. Math comes easily to me.	SD	D	N	A	SA

SD = strongly disagree **D** = disagree **N** = neither agree nor disagree
A = agree **SA** = strongly agree

Statement	*How I Feel*				
13. I hate math.	SD	D	N	A	SA
14. I enjoy playing math games.	SD	D	N	A	SA
15. I can tell if my answers in math make sense.	SD	D	N	A	SA
16. I enjoy studying math.	SD	D	N	A	SA
17. Doing math is easy for me.	SD	D	N	A	SA
18. Solving math problems is fun.	SD	D	N	A	SA

About you:

- Are you a boy or girl? ______________________
- Please circle which grade you are in: 3^{rd} 4^{th} 5^{th} 6^{th}
- Please circle your ethnicity (you may circle more than one)

Asian or Pacific Islander

Black

Hispanic

Native American or Alaska Native

White

Thank you for completing the survey!

STATA COMMANDS AND OUTPUT

Random Sample Ethnic Distribution of Region 1

0 – No Response, 1 – White, 2 – Hispanic, 3 – Black, 4 – Asian and Pacific Islander, 5 – Native American and Alaska Native, 6 - Multiracial

```
. tabulate Ethnicity if Region==1
```

Ethnicity Fix	Freq.	Percent	Cum.
0	3	0.80	0.80
1	117	31.20	32.00
2	97	25.87	57.87
3	26	6.93	64.80
4	11	2.93	67.73
5	7	1.87	69.60
6	114	30.40	100.00
Total	375	100.00	

Selective Sample Ethnic Distribution of Region 1

0 – No Response, 1 – White, 2 – Hispanic, 3 – Black, 4 – Asian and Pacific Islander, 5 – Native American and Alaska Native, 6 - Multiracial

```
. tabulate Ethnicity if Region==1
```

Ethnicity	Freq.	Percent	Cum.
0	1	0.27	0.27
1	42	11.20	11.47
2	183	48.80	60.27
3	26	6.93	67.20
4	28	7.47	74.67
5	9	2.40	77.07
6	86	22.93	100.00
Total	375	100.00	

Ethnic Distribution of Region 2

0 – No Response, 1 – White, 2 – Hispanic, 3 – Black, 4 – Asian and Pacific Islander, 5 – Native American and Alaska Native, 6 - Multiracial

```
. tabulate Ethnicity if Region==2
```

Ethnicity Fix	Freq.	Percent	Cum.
0	11	2.93	2.93
1	33	8.80	11.73
2	250	66.67	78.40
3	11	2.93	81.33
4	4	1.07	82.40
5	6	1.60	84.00
6	60	16.00	100.00
Total	375	100.00	

Selective Sample MANOVA

```
. manova selfperception enjoyment = Boyorgirl Grade Region Ethnicity Boyorgirl#Ethnicity Grade#Region Region#Ethnicity, dropemptycells
```

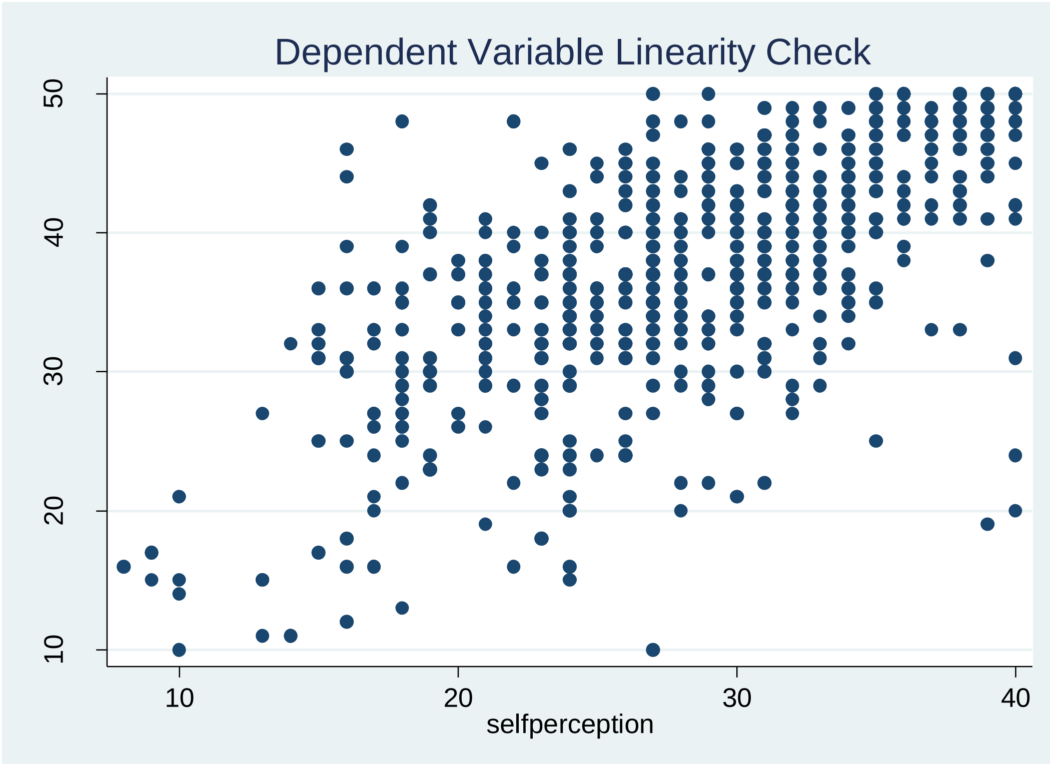
Number of obs = 709

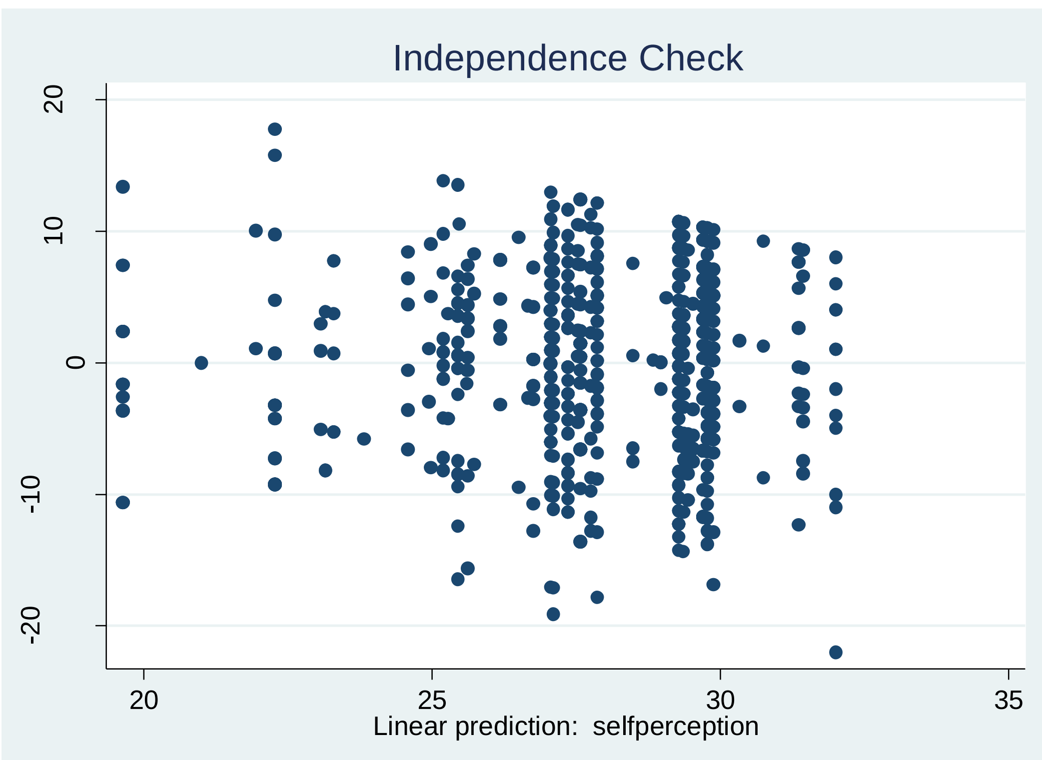
W = Wilks' lambda L = Lawley-Hotelling trace
P = Pillai's trace R = Roy's largest root

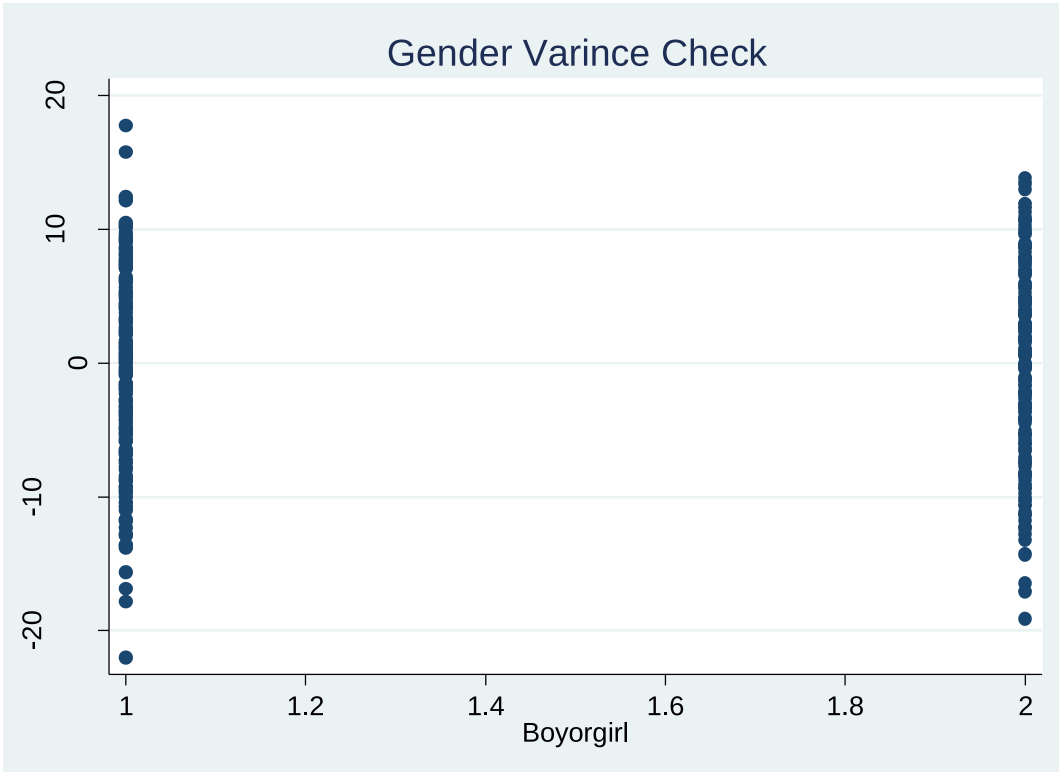
Source		Statistic	df	F(df1,	df2) =	F	Prob>F	
Model	W	0.7738	22	44.0	1370.0	4.26	0.0000	e
	P	0.2407		44.0	1372.0	4.27	0.0000	a
	L	0.2737		44.0	1368.0	4.25	0.0000	a
	R	0.1409		22.0	686.0	4.39	0.0000	u
Residual			686					
Boyorgirl	W	0.9936	1	2.0	685.0	2.22	0.1095	e
	P	0.0064		2.0	685.0	2.22	0.1095	e
	L	0.0065		2.0	685.0	2.22	0.1095	e
	R	0.0065		2.0	685.0	2.22	0.1095	e
Grade	W	0.9763	1	2.0	685.0	8.33	0.0003	e
	P	0.0237		2.0	685.0	8.33	0.0003	e
	L	0.0243		2.0	685.0	8.33	0.0003	e
	R	0.0243		2.0	685.0	8.33	0.0003	e
Region	W	0.9973	1	2.0	685.0	0.92	0.3987	e
	P	0.0027		2.0	685.0	0.92	0.3987	e
	L	0.0027		2.0	685.0	0.92	0.3987	e
	R	0.0027		2.0	685.0	0.92	0.3987	e
Ethnicity	W	0.9739	6	12.0	1370.0	1.52	0.1098	e
	P	0.0263		12.0	1372.0	1.52	0.1097	a
	L	0.0267		12.0	1368.0	1.52	0.1098	a
	R	0.0193		6.0	686.0	2.20	0.0412	u
Boyorgirl#Ethnicity	W	0.9573	6	12.0	1370.0	2.52	0.0028	e
	P	0.0430		12.0	1372.0	2.51	0.0028	a
	L	0.0442		12.0	1368.0	2.52	0.0028	a
	R	0.0330		6.0	686.0	3.78	0.0010	u
Grade#Region	W	0.9853	1	2.0	685.0	5.10	0.0063	e
	P	0.0147		2.0	685.0	5.10	0.0063	e
	L	0.0149		2.0	685.0	5.10	0.0063	e
	R	0.0149		2.0	685.0	5.10	0.0063	e
Region#Ethnicity	W	0.9656	6	12.0	1370.0	2.02	0.0199	e
	P	0.0347		12.0	1372.0	2.02	0.0199	a
	L	0.0353		12.0	1368.0	2.01	0.0200	a
	R	0.0241		6.0	686.0	2.76	0.0117	u
Residual			686					
Total			708					

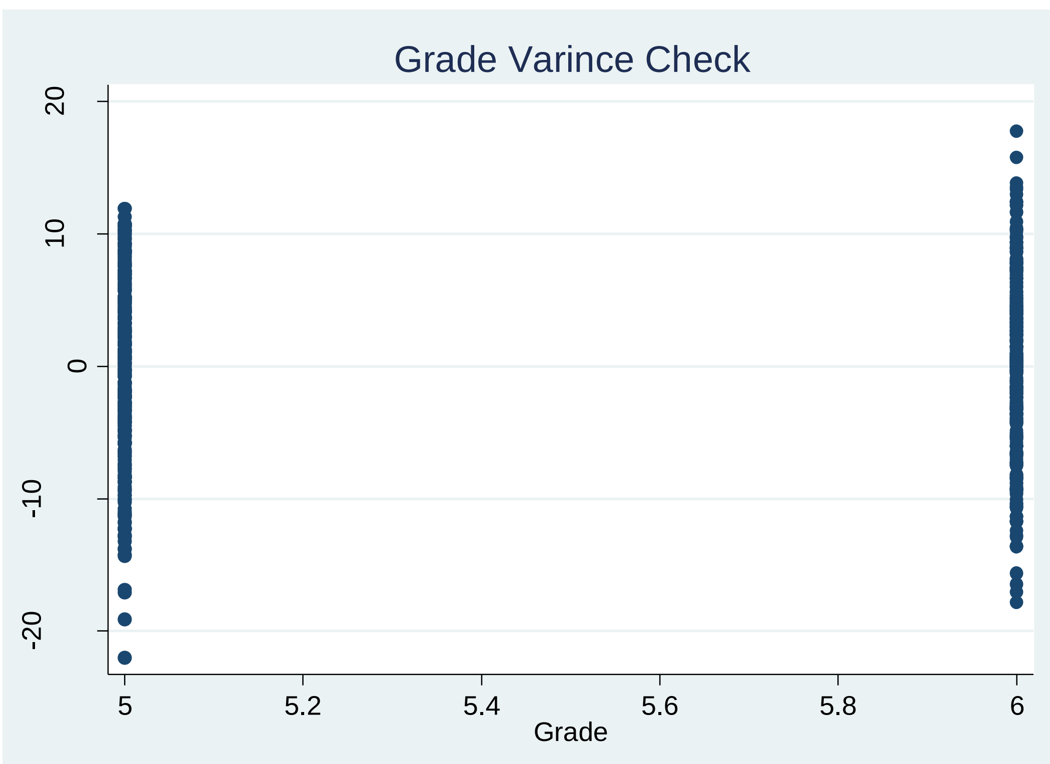
e = exact, a = approximate, u = upper bound on F

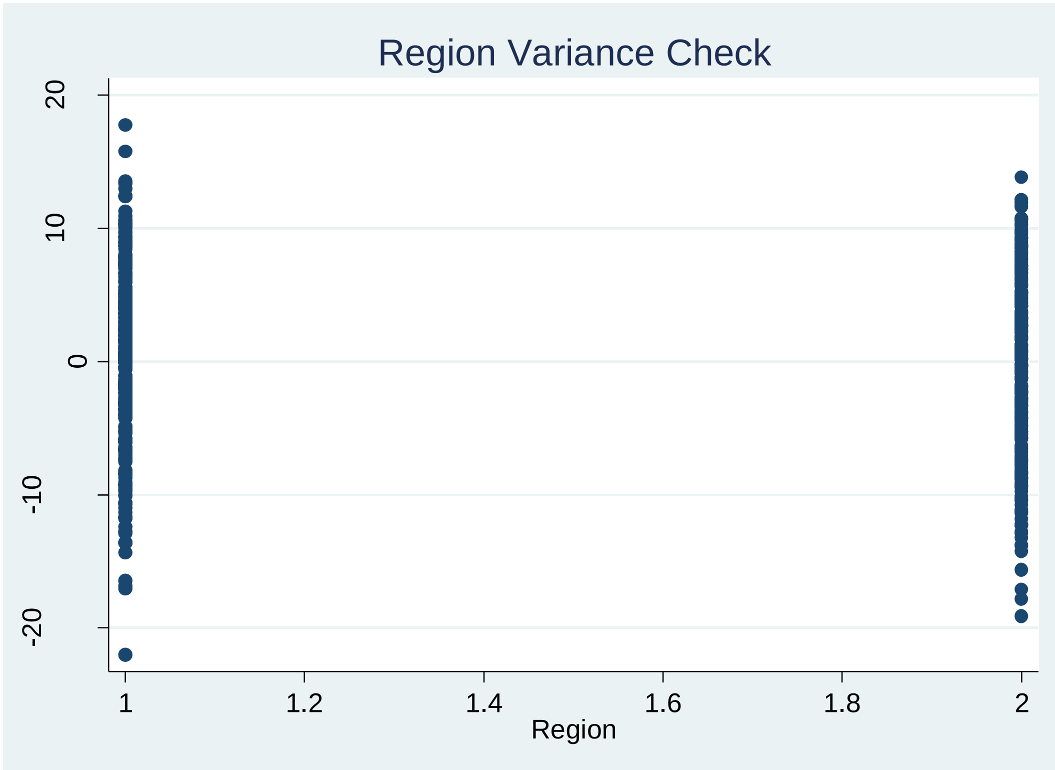
Selective Sample MANOVA Assumptions Check

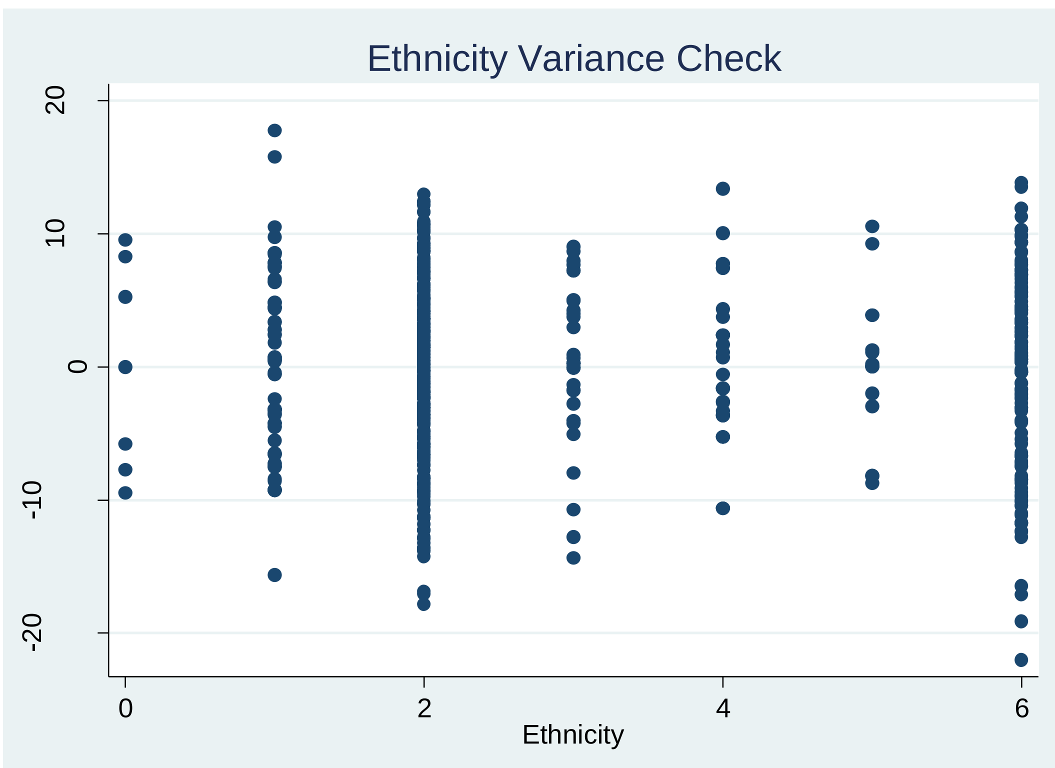





Gender Varince Check
20
10
0
-10
-20
1
1.2
1.4
1.6
1.8
2
Boyorgirl


Grade Varince Check
20
10
0
-10
-20
5
5.2
5.4
5.6
5.8
6
Grade


Region Variance Check
20
10
0
-10
-20
1
1.2
1.4
1.6
1.8
2
Region

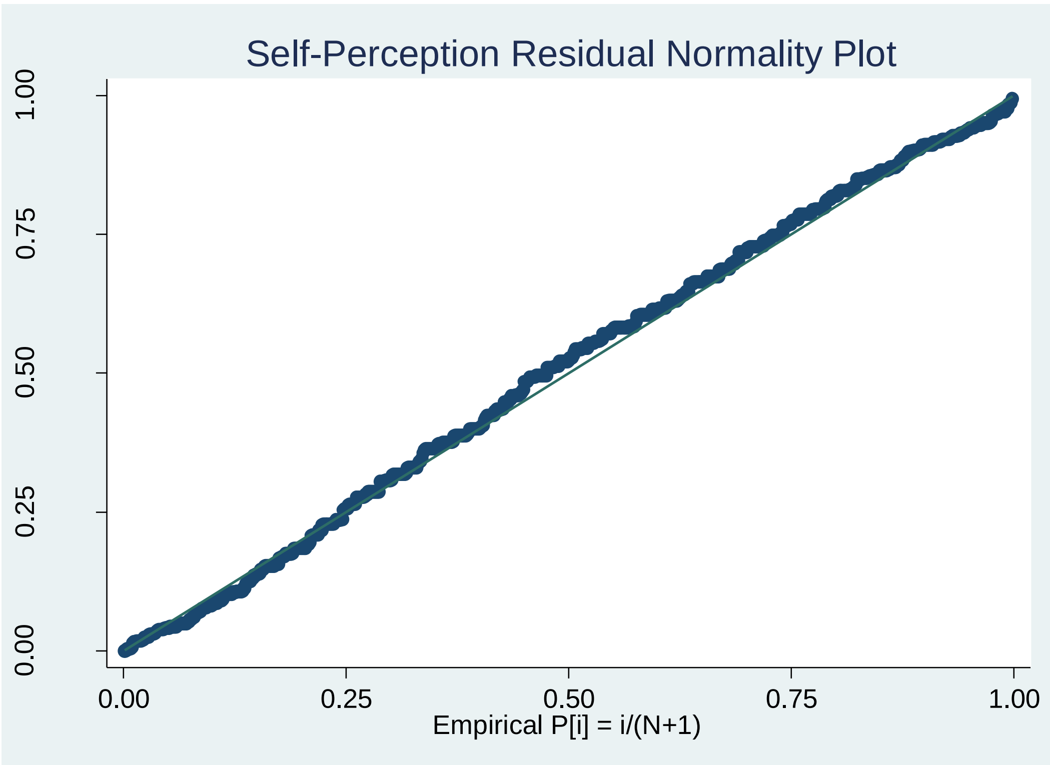

Ethnicity Variance Check
20
10
0
-10
-20
0
2
4
6
Ethnicity

Selective Sample Self-Perception ANOVA

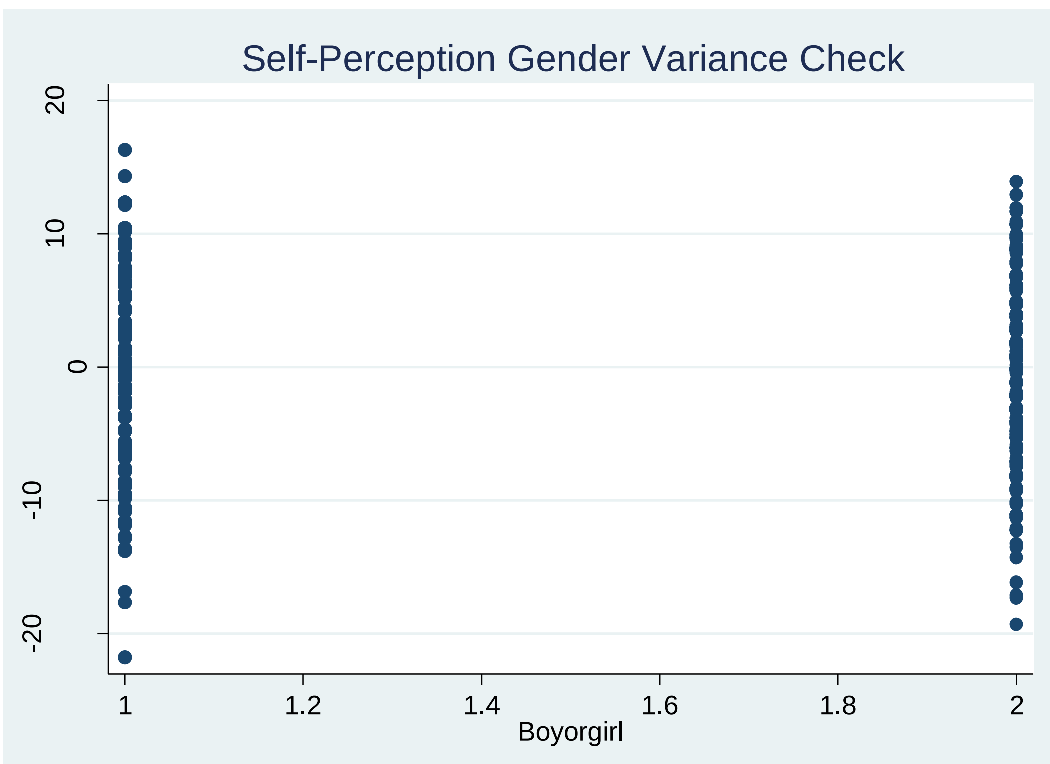
```
. anova selfperception Boyorgirl Grade Ethnicity Boyorgirl#Ethnicity, dropemptycells

                           Number of obs =        723    R-squared     =  0.1083
                           Root MSE      =    6.55197    Adj R-squared =  0.0906
```

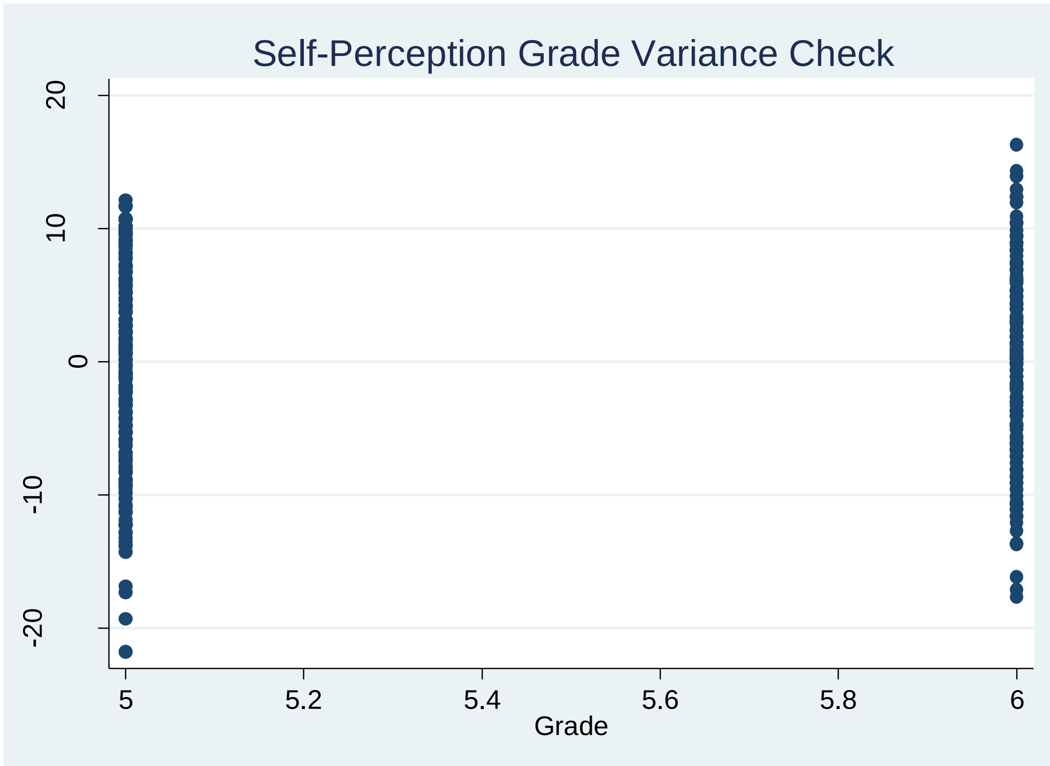
Source	Partial SS	df	MS	F	Prob > F
Model	3689.9072	14	263.5648	6.14	0.0000
Boyorgirl	103.384381	1	103.384381	2.41	0.1211
Grade	823.879691	1	823.879691	19.19	0.0000
Ethnicity	961.164427	6	160.194071	3.73	0.0012
Boyorgirl#Ethnicity	1086.51389	6	181.085648	4.22	0.0004
Residual	30393.2076	708	42.9282593		
Total	34083.1148	722	47.2065302		

Selective Sample Self-Perception ANOVA Assumptions Check

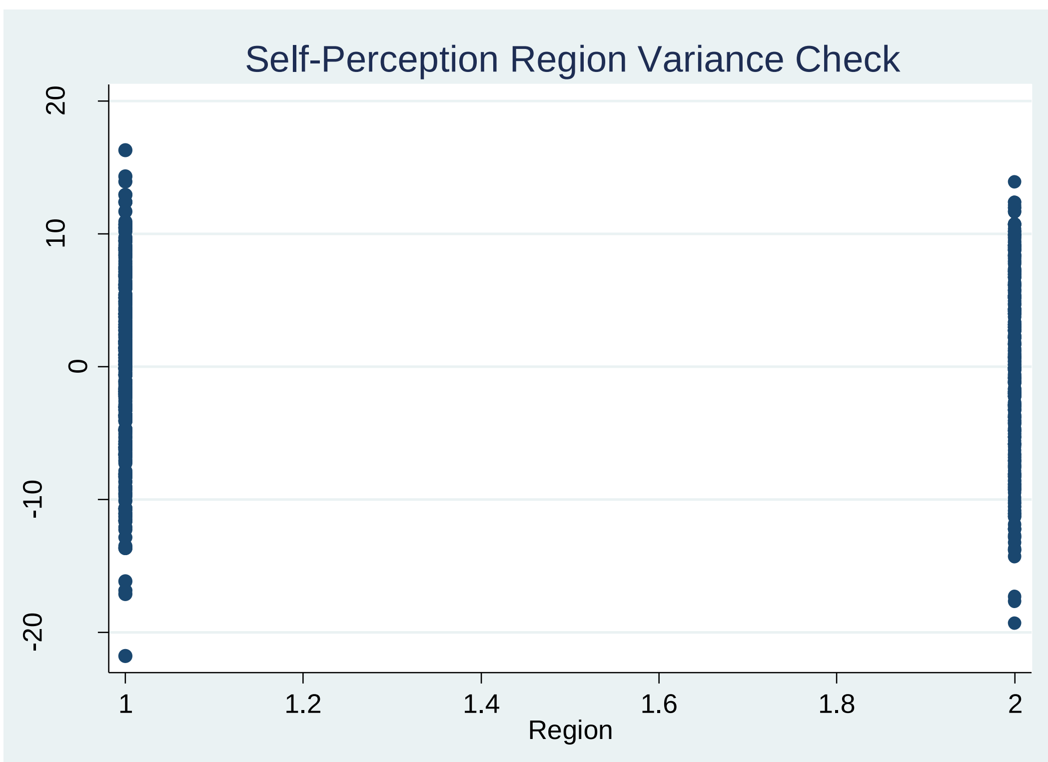



Self-Perception Independence Check
20
10
0
-10
-20
20
25
30
35
Fitted values


Self-Perception Gender Variance Check
20
10
0
-10
-20
1
1.2
1.4
1.6
1.8
2
Boyorgirl



Self-Perception Grade Variance Check
20
10
0
-10
-20
5
5.2
5.4
5.6
5.8
6
Grade



Self-Perception Region Variance Check
20
10
0
-10
-20
1
1.2
1.4
1.6
1.8
2
Region

Selective Sample Self-Perception Contrasts

Ethnicity Codes: 0 – No Response, 1 – White, 2 – Hispanic, 3 – Black, 4 – Asian and Pacific Islander, 5 – Native American and Alaska Native, 6 - Multiracial

Gender Codes: 1 – Boy, 2 - Girl

```
. pwcompare Grade Boyorgirl#Ethnicity, mcompare(tukey)

Pairwise comparisons of marginal linear predictions

Margins      : asbalanced
```

	Number of Comparisons
Grade	1
Boyorgirl#Ethnicity	91

	Contrast	Std. Err.	Tukey [95% Conf.	Interval]
Grade				
6 vs 5	-2.18918	.4997135	-3.170277	-1.208082
Boyorgirl#Ethnicity				
(1 1) vs (1 0)	-.636343	4.747273	-16.61295	15.34027
(1 2) vs (1 0)	3.345303	4.661767	-12.34354	19.03415
(1 3) vs (1 0)	1.301344	4.875486	-15.10676	17.70945
(1 4) vs (1 0)	-.1068858	5.046565	-17.09075	16.87697
(1 5) vs (1 0)	4.493237	5.189191	-12.97062	21.95709
(1 6) vs (1 0)	5.251103	4.713019	-10.61023	21.11243
(2 0) vs (1 0)	-1.662164	5.482679	-20.11373	16.78941
(2 1) vs (1 0)	3.535409	4.797961	-12.61179	19.68261

(2 2) vs (1 0)	2.759405	4.66081	-12.92622	18.44503
(2 3) vs (1 0)	1.988284	4.937651	-14.62903	18.6056
(2 4) vs (1 0)	-4.203998	4.865386	-20.57811	12.17011
(2 5) vs (1 0)	-1.24904	5.261015	-18.95461	16.45653
(2 6) vs (1 0)	.8066619	4.700775	-15.01346	16.62679
(1 2) vs (1 1)	3.981646	1.087693	.3210926	7.6422
(1 3) vs (1 1)	1.937687	1.761663	-3.991066	7.86644
(1 4) vs (1 1)	.5294572	2.20391	-6.887646	7.946561
(1 5) vs (1 1)	5.12958	2.514162	-3.331656	13.59082
(1 6) vs (1 1)	5.887446	1.262909	1.637214	10.13768
(2 0) vs (1 1)	-1.025821	3.098273	-11.45284	9.401199
(2 1) vs (1 1)	4.171752	1.561712	-1.084079	9.427584
(2 2) vs (1 1)	3.395748	1.076418	-.2268613	7.018358
(2 3) vs (1 1)	2.624627	1.956573	-3.960081	9.209334
(2 4) vs (1 1)	-3.567655	1.73257	-9.398496	2.263187
(2 5) vs (1 1)	-.6126973	2.662708	-9.573854	8.348459
(2 6) vs (1 1)	1.443005	1.239309	-2.727803	5.613813
(1 3) vs (1 2)	-2.04396	1.546435	-7.248379	3.160459
(1 4) vs (1 2)	-3.452189	2.031329	-10.28848	3.384105
(1 5) vs (1 2)	1.147934	2.364059	-6.808141	9.104009
(1 6) vs (1 2)	1.9058	.930791	-1.226712	5.038311
(2 0) vs (1 2)	-5.007467	2.969495	-15.00109	4.986159
(2 1) vs (1 2)	.1901062	1.303162	-4.195594	4.575807
(2 2) vs (1 2)	-.585898	.642063	-2.746716	1.57492
(2 3) vs (1 2)	-1.357019	1.754316	-7.261047	4.547008
(2 4) vs (1 2)	-7.549301	1.513574	-12.64313	-2.455476
(2 5) vs (1 2)	-4.594343	2.520234	-13.07601	3.887328
(2 6) vs (1 2)	-2.538641	.8879308	-5.52691	.4496272
(1 4) vs (1 3)	-1.408229	2.460827	-9.689968	6.873509
(1 5) vs (1 3)	3.191894	2.742279	-6.037052	12.42084
(1 6) vs (1 3)	3.949759	1.671006	-1.673892	9.573411
(2 0) vs (1 3)	-2.963508	3.289675	-14.03468	8.107661
(2 1) vs (1 3)	2.234066	1.908426	-4.188608	8.656739
(2 2) vs (1 3)	1.458062	1.537714	-3.717008	6.633131
(2 3) vs (1 3)	.6869402	2.244113	-6.865463	8.239344
(2 4) vs (1 3)	-5.505341	2.047105	-12.39473	1.384046
(2 5) vs (1 3)	-2.550384	2.879595	-12.24146	7.14069
(2 6) vs (1 3)	-.4946817	1.655981	-6.06777	5.078406
(1 5) vs (1 4)	4.600123	3.044443	-5.645735	14.84598
(1 6) vs (1 4)	5.357989	2.131524	-1.815503	12.53148
(2 0) vs (1 4)	-1.555278	3.540589	-13.47088	10.36032
(2 1) vs (1 4)	3.642295	2.320483	-4.167128	11.45172
(2 2) vs (1 4)	2.866291	2.025606	-3.950741	9.683323
(2 3) vs (1 4)	2.09517	2.602238	-6.66248	10.85282
(2 4) vs (1 4)	-4.097112	2.440135	-12.30921	4.114991
(2 5) vs (1 4)	-1.142155	3.168001	-11.80384	9.519529
(2 6) vs (1 4)	.9135477	2.116614	-6.209767	8.036862
(1 6) vs (1 5)	.7578658	2.450919	-7.490529	9.006261
(2 0) vs (1 5)	-6.155401	3.741228	-18.74624	6.435438
(2 1) vs (1 5)	-.9578278	2.616803	-9.764494	7.848838
(2 2) vs (1 5)	-1.733832	2.359197	-9.673544	6.20588
(2 3) vs (1 5)	-2.504953	2.869525	-12.16214	7.152232
(2 4) vs (1 5)	-8.697235	2.723736	-17.86378	.4693064
(2 5) vs (1 5)	-5.742277	3.39107	-17.15469	5.67013
(2 6) vs (1 5)	-3.686575	2.437773	-11.89073	4.517578
(2 0) vs (1 6)	-6.913267	3.046056	-17.16455	3.338021
(2 1) vs (1 6)	-1.715694	1.457312	-6.620174	3.188786
(2 2) vs (1 6)	-2.491698	.9179844	-5.581109	.5977139
(2 3) vs (1 6)	-3.262819	1.873933	-9.569407	3.043769
(2 4) vs (1 6)	-9.455101	1.640352	-14.97559	-3.934612
(2 5) vs (1 6)	-6.500143	2.602911	-15.26006	2.25977
(2 6) vs (1 6)	-4.444441	1.104429	-8.161318	-.727564
(2 1) vs (2 0)	5.197573	3.177551	-5.496249	15.8914
(2 2) vs (2 0)	4.421569	2.967236	-5.564454	14.40759
(2 3) vs (2 0)	3.650448	3.386044	-7.745044	15.04594
(2 4) vs (2 0)	-2.541833	3.274542	-13.56207	8.478408
(2 5) vs (2 0)	.4131238	3.840926	-12.51324	13.33949
(2 6) vs (2 0)	2.468826	3.029771	-7.727656	12.66531

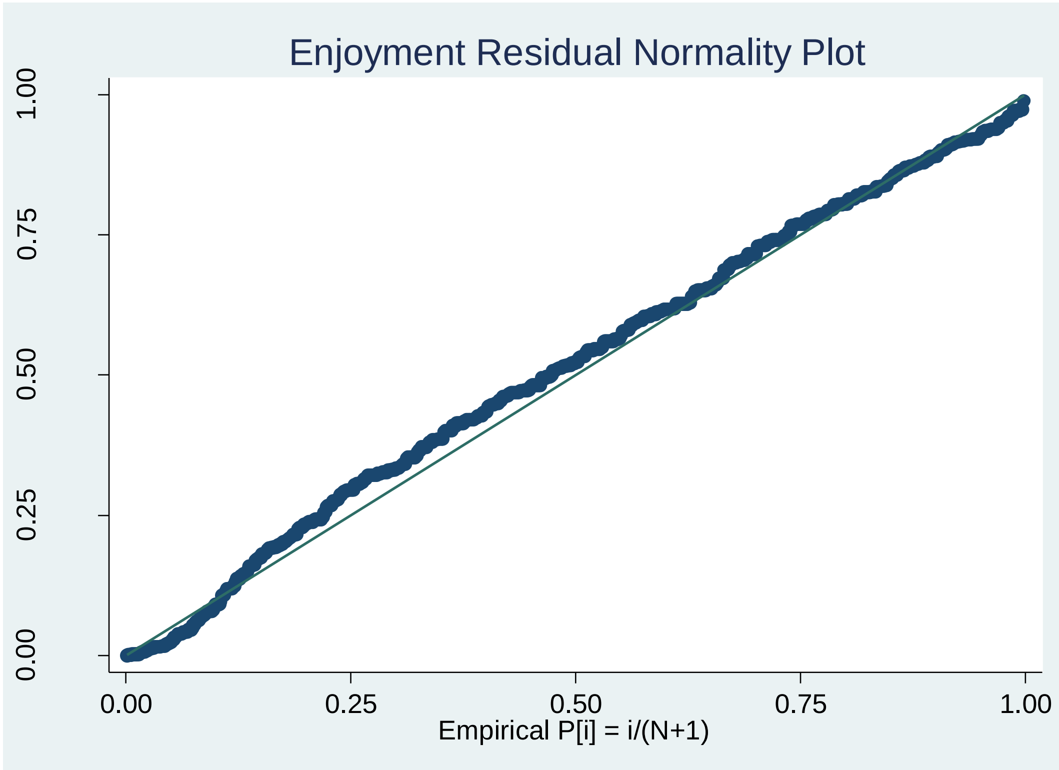
(2 2) vs (2 1)	-.7760042	1.294957	-5.134092	3.582084
(2 3) vs (2 1)	-1.547126	2.084221	-8.561423	5.467172
(2 4) vs (2 1)	-7.739407	1.881777	-14.07239	-1.40642
(2 5) vs (2 1)	-4.78445	2.759165	-14.07022	4.501325
(2 6) vs (2 1)	-2.728747	1.433008	-7.551436	2.093941
(2 3) vs (2 2)	-.7711215	1.748777	-6.656506	5.114263
(2 4) vs (2 2)	-6.963403	1.504591	-12.027	-1.899808
(2 5) vs (2 2)	-4.008446	2.515914	-12.47558	4.458684
(2 6) vs (2 2)	-1.952743	.8765935	-4.902857	.9973703
(2 4) vs (2 3)	-6.192281	2.221585	-13.66887	1.284307
(2 5) vs (2 3)	-3.237324	2.999539	-13.33206	6.857412
(2 6) vs (2 3)	-1.181622	1.853224	-7.418516	5.055272
(2 5) vs (2 4)	2.954957	2.861987	-6.676857	12.58677
(2 6) vs (2 4)	5.010659	1.625283	-.459116	10.48043
(2 6) vs (2 5)	2.055702	2.589693	-6.659726	10.77113

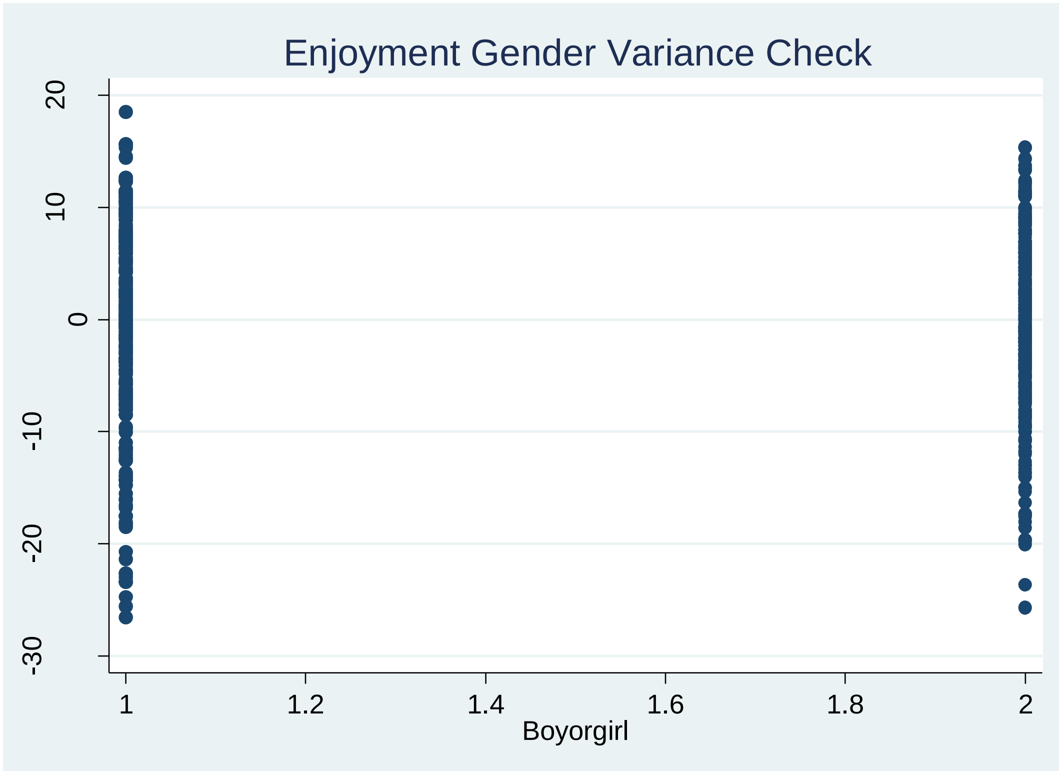
Selective Sample Enjoyment ANOVA

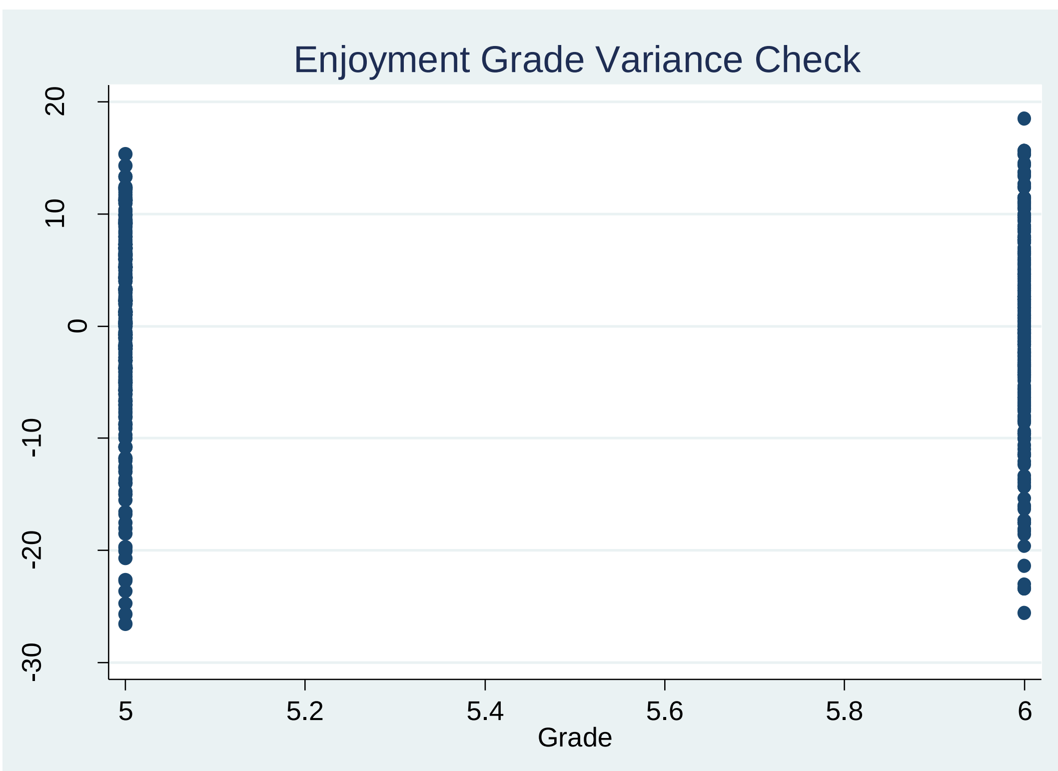
```
. rename yhat spyhat

. anova enjoyment Boyorgirl Grade Region Ethnicity Boyorgirl#Ethnicity Grade#Region Region#Ethnicity, dropemptycells

                           Number of obs =        719    R-squared     =  0.1145
                           Root MSE      =    8.23326    Adj R-squared =  0.0865
```

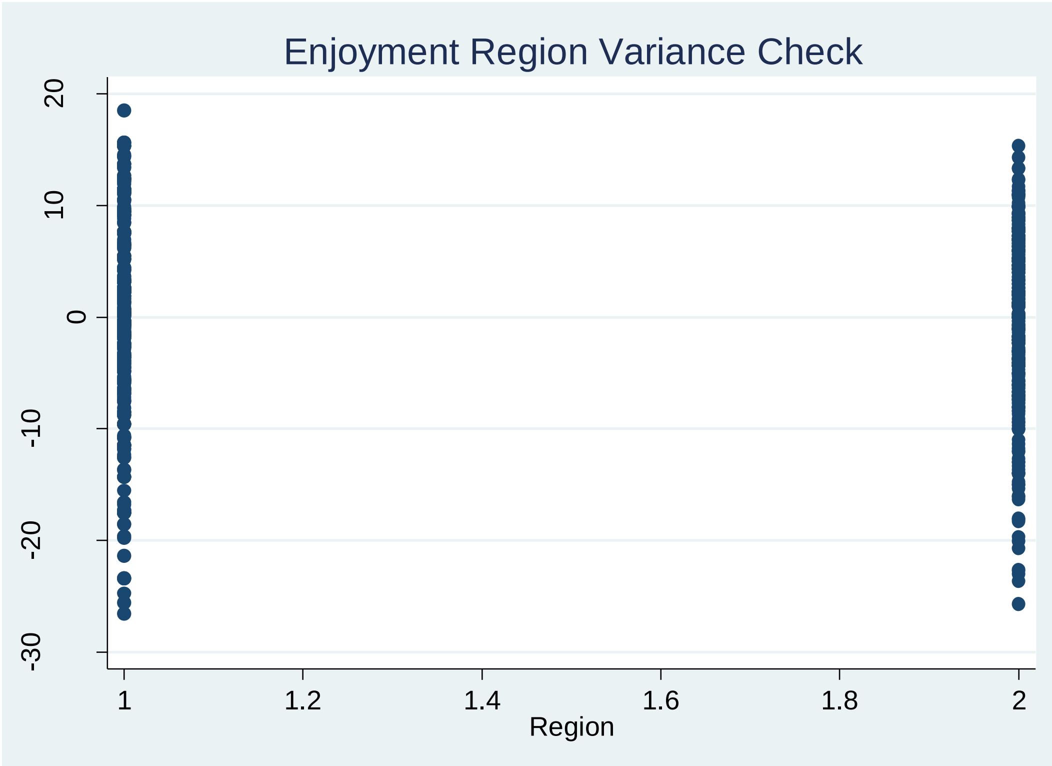
Source	Partial SS	df	MS	F	Prob > F
Model	6099.25814	22	277.239007	4.09	0.0000
Boyorgirl	2.63407698	1	2.63407698	0.04	0.8438
Grade	321.253667	1	321.253667	4.74	0.0298
Region	2.71904971	1	2.71904971	0.04	0.8413
Ethnicity	325.825282	6	54.3042136	0.80	0.5692
Boyorgirl#Ethnicity	1456.91138	6	242.818563	3.58	0.0017
Grade#Region	493.083202	1	493.083202	7.27	0.0072
Region#Ethnicity	952.451418	6	158.741903	2.34	0.0302
Residual	47179.4512	696	67.7865678		
Total	53278.7093	718	74.2043305		

Selective Sample Enjoyment ANOVA Assumptions Check




Enjoyment Gender Variance Check
20
10
0
-10
-20
-30
1
1.2
1.4
1.6
1.8
2
Boyorgirl


Enjoyment Grade Variance Check
20
10
0
-10
-20
-30
5
5.2
5.4
5.6
5.8
6
Grade


Enjoyment Region Variance Check
20
10
0
-10
-20
-30
1
1.2
1.4
1.6
1.8
2
Region


Enjoyment Ethnicity Variance Check
20
10
0
-10
-20
-30
0
2
4
6
Ethnicity

Selective Sample Enjoyment Contrasts

Ethnicity Codes: 0 – No Response, 1 – White, 2 – Hispanic, 3 – Black, 4 – Asian and Pacific Islander, 5 – Native American and Alaska Native, 6 - Multiracial

Gender Codes: 1 – Boy, 2 - Girl

```
. pwcompare Grade Boyorgirl#Ethnicity Grade#Region Ethnicity#Region, mcom
> pare(tukey)

Pairwise comparisons of marginal linear predictions

Margins      : asbalanced
```

	Number of Comparisons
Grade	1
Boyorgirl#Ethnicity	91
Grade#Region	6
Ethnicity#Region	91

	Contrast	Std. Err.	Tukey [95% Conf.	Interval]
Grade				
6 vs 5	-1.4387	.660873	-2.736243	-.1411563
Boyorgirl#Ethnicity				
(1 1) vs (1 0)	-5.985997	7.546412	-31.38445	19.41246
(1 2) vs (1 0)	.0006709	7.455357	-25.09133	25.09267
(1 3) vs (1 0)	-1.13964	7.672392	-26.9621	24.68282
(1 4) vs (1 0)	-2.613524	7.960294	-29.40496	24.17791
(1 5) vs (1 0)	3.021835	7.989216	-23.86694	29.91061
(1 6) vs (1 0)	.0626224	7.514609	-25.22879	25.35404
(2 0) vs (1 0)	-1.333135	7.133898	-25.34322	22.67695
(2 1) vs (1 0)	2.436904	7.584564	-23.08996	27.96376
(2 2) vs (1 0)	.2846684	7.454895	-24.80577	25.37511
(2 3) vs (1 0)	-.8161677	7.780822	-27.00356	25.37123
(2 4) vs (1 0)	-.8235803	7.857399	-27.2687	25.62154
(2 5) vs (1 0)	-2.566982	8.11266	-29.87122	24.73726
(2 6) vs (1 0)	-1.923783	7.492802	-27.14181	23.29424
(1 2) vs (1 1)	5.986668	1.398225	1.280756	10.69258
(1 3) vs (1 1)	4.846358	2.257991	-2.753212	12.44593
(1 4) vs (1 1)	3.372473	3.13248	-7.170306	13.91525
(1 5) vs (1 1)	9.007833	3.177131	-1.685224	19.70089
(1 6) vs (1 1)	6.04862	1.661151	.4577936	11.63945
(2 0) vs (1 1)	4.652862	4.788949	-11.46498	20.77071
(2 1) vs (1 1)	8.422902	1.964292	1.811816	15.03399
(2 2) vs (1 1)	6.270666	1.383853	1.613123	10.92821
(2 3) vs (1 1)	5.16983	2.651809	-3.755187	14.09485
(2 4) vs (1 1)	5.162417	2.848423	-4.424329	14.74916
(2 5) vs (1 1)	3.419016	3.497955	-8.353818	15.19185
(2 6) vs (1 1)	4.062214	1.581332	-1.259969	9.384397
(1 3) vs (1 2)	-1.140311	1.968423	-7.7653	5.484679
(1 4) vs (1 2)	-2.614195	2.921494	-12.44687	7.218482
(1 5) vs (1 2)	3.021164	2.976928	-6.998082	13.04041
(1 6) vs (1 2)	.0619514	1.233211	-4.088586	4.212489
(2 0) vs (1 2)	-1.333806	4.648763	-16.97984	14.31222
(2 1) vs (1 2)	2.436234	1.615221	-3.000007	7.872474
(2 2) vs (1 2)	.2839975	.810933	-2.445306	3.013301
(2 3) vs (1 2)	-.8168386	2.396412	-8.882283	7.248606
(2 4) vs (1 2)	-.8242512	2.618109	-9.635846	7.987343
(2 5) vs (1 2)	-2.567653	3.311311	-13.71231	8.577006
(2 6) vs (1 2)	-1.924454	1.115725	-5.679577	1.830669
(1 4) vs (1 3)	-1.473884	3.419167	-12.98155	10.03378
(1 5) vs (1 3)	4.161475	3.459984	-7.483562	15.80651
(1 6) vs (1 3)	1.202262	2.160802	-6.070206	8.474731
(2 0) vs (1 3)	-.1934956	4.989096	-16.98496	16.59797
(2 1) vs (1 3)	3.576544	2.402972	-4.510979	11.66407
(2 2) vs (1 3)	1.424308	1.958837	-5.168417	8.017033
(2 3) vs (1 3)	.3234721	2.82629	-9.188785	9.835729
(2 4) vs (1 3)	.3160595	3.158443	-10.3141	10.94622
(2 5) vs (1 3)	-1.427342	3.757397	-14.07336	11.21868
(2 6) vs (1 3)	-.7841437	2.099023	-7.848685	6.280398

(1 5) vs (1 4)	5.635359	4.081163	-8.10034	19.37106
(1 6) vs (1 4)	2.676146	3.058888	-7.618949	12.97124
(2 0) vs (1 4)	1.280389	5.428812	-16.991	19.55178
(2 1) vs (1 4)	5.050429	3.232376	-5.828565	15.92942
(2 2) vs (1 4)	2.898193	2.917327	-6.92046	12.71685
(2 3) vs (1 4)	1.797356	3.682584	-10.59687	14.19158
(2 4) vs (1 4)	1.789944	3.089797	-8.609181	12.18907
(2 5) vs (1 4)	.0465424	4.32972	-14.52571	14.61879
(2 6) vs (1 4)	.6897407	3.011022	-9.444254	10.82374
(1 6) vs (1 5)	-2.959213	3.107555	-13.4181	7.499678
(2 0) vs (1 5)	-4.354971	5.466292	-22.7525	14.04256
(2 1) vs (1 5)	-.5849308	3.280599	-11.62622	10.45636
(2 2) vs (1 5)	-2.737167	2.97109	-12.73677	7.262432
(2 3) vs (1 5)	-3.838003	3.731722	-16.39761	8.721605
(2 4) vs (1 5)	-3.845415	3.864986	-16.85354	9.162709
(2 5) vs (1 5)	-5.588817	4.368807	-20.29262	9.114986
(2 6) vs (1 5)	-4.945619	3.063965	-15.2578	5.366565
(2 0) vs (1 6)	-1.395758	4.741977	-17.35551	14.564
(2 1) vs (1 6)	2.374282	1.851242	-3.856318	8.604882
(2 2) vs (1 6)	.2220461	1.218626	-3.879401	4.323493
(2 3) vs (1 6)	-.87879	2.565938	-9.514797	7.757217
(2 4) vs (1 6)	-.8862026	2.767666	-10.20115	8.428745
(2 5) vs (1 6)	-2.629604	3.432795	-14.18313	8.923927
(2 6) vs (1 6)	-1.986406	1.445714	-6.852149	2.879337
(2 1) vs (2 0)	3.77004	4.852555	-12.56188	20.10196
(2 2) vs (2 0)	1.617804	4.646613	-14.02099	17.2566
(2 3) vs (2 0)	.5169677	5.158642	-16.84513	17.87907
(2 4) vs (2 0)	.5095551	5.276756	-17.25007	18.26918
(2 5) vs (2 0)	-1.233846	5.6487	-20.2453	17.77761
(2 6) vs (2 0)	-.590648	4.71015	-16.44329	15.26199
(2 2) vs (2 1)	-2.152236	1.604745	-7.553218	3.248746
(2 3) vs (2 1)	-3.253072	2.768411	-12.57053	6.064383
(2 4) vs (2 1)	-3.260485	2.959793	-13.22206	6.701093
(2 5) vs (2 1)	-5.003886	3.588403	-17.08113	7.073362
(2 6) vs (2 1)	-4.360688	1.776346	-10.33922	1.617843
(2 3) vs (2 2)	-1.100836	2.391302	-9.149082	6.94741
(2 4) vs (2 2)	-1.108249	2.612891	-9.902283	7.685785
(2 5) vs (2 2)	-2.85165	3.307363	-13.98302	8.279721
(2 6) vs (2 2)	-2.208452	1.101542	-5.915838	1.498934
(2 4) vs (2 3)	-.0074126	3.44869	-11.61444	11.59961
(2 5) vs (2 3)	-1.750814	3.999626	-15.21209	11.71046
(2 6) vs (2 3)	-1.107616	2.508621	-9.550714	7.335482
(2 5) vs (2 4)	-1.743401	4.12932	-15.64118	12.15438
(2 6) vs (2 4)	-1.100203	2.715847	-10.24075	8.040341
(2 6) vs (2 5)	.6431983	3.390753	-10.76883	12.05523
Grade#Region				
(5 2) vs (5 1)	-2.113992	1.821507	-6.804824	2.57684
(6 1) vs (5 1)	-3.209941	.9459898	-5.6461	-.7737825
(6 2) vs (5 1)	-1.781451	1.9225	-6.732366	3.169465
(6 1) vs (5 2)	-1.095949	1.742131	-5.582368	3.39047
(6 2) vs (5 2)	.3325414	.9171741	-2.02941	2.694492
(6 2) vs (6 1)	1.42849	1.844514	-3.321592	6.178572
Ethnicity#Region				
(0 2) vs (0 1)	-6.561894	9.219986	-37.59299	24.4692
(1 1) vs (0 1)	-7.76072	9.092678	-38.36334	22.8419
(1 2) vs (0 1)	-1.017131	9.102413	-31.65251	29.61825
(2 1) vs (0 1)	-3.956447	9.011929	-34.28729	26.3744
(2 2) vs (0 1)	-.9869727	9.000518	-31.27942	29.30547
(3 1) vs (0 1)	-1.454172	9.14574	-32.23538	29.32704
(3 2) vs (0 1)	-5.730394	9.36903	-37.26311	25.80232
(4 1) vs (0 1)	-5.020537	9.157847	-35.84249	25.80142
(4 2) vs (0 1)	-3.645326	9.888537	-36.92652	29.63586
(5 1) vs (0 1)	-.7250191	9.424486	-32.44438	30.99434
(5 2) vs (0 1)	-4.048886	9.62135	-36.43082	28.33305
(6 1) vs (0 1)	-3.882187	9.044115	-34.32136	26.55699
(6 2) vs (0 1)	-3.207733	9.055432	-33.685	27.26953

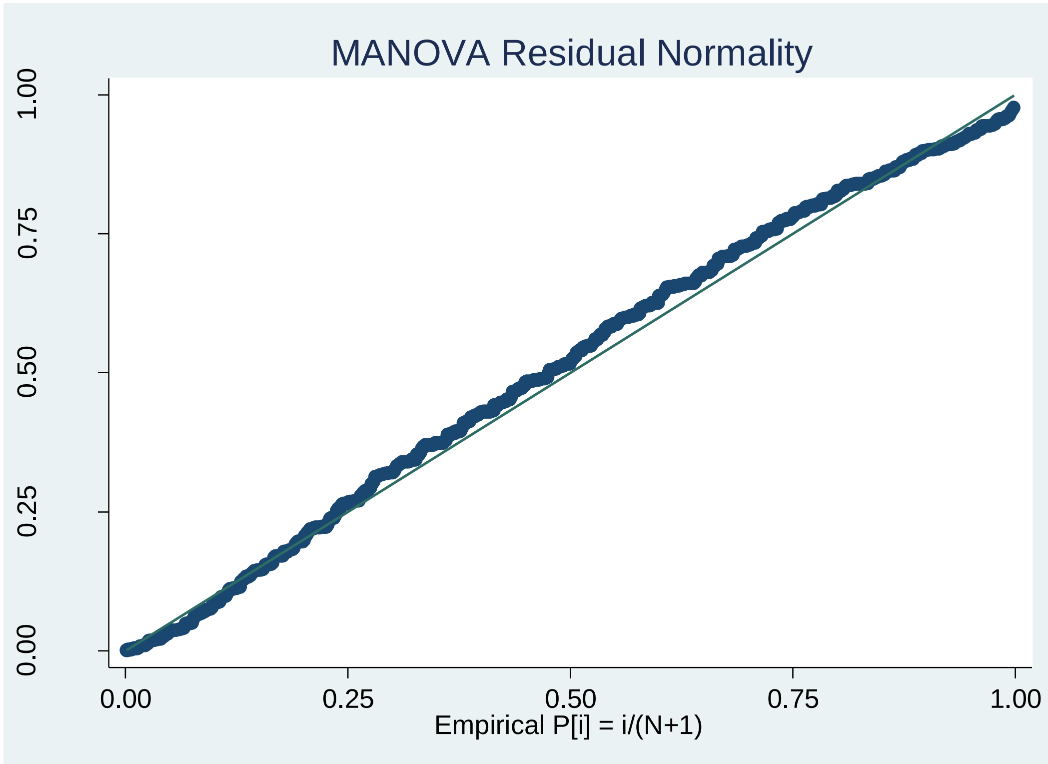
(1 1) vs (0 2)	-1.198826	3.81592	-14.04181	11.64416
(1 2) vs (0 2)	5.544763	3.866353	-7.467965	18.55749
(2 1) vs (0 2)	2.605447	3.635502	-9.630321	14.84122
(2 2) vs (0 2)	5.574921	3.614141	-6.588953	17.7388
(3 1) vs (0 2)	5.107722	3.937741	-8.14527	18.36071
(3 2) vs (0 2)	.8314997	4.452822	-14.15507	15.81807
(4 1) vs (0 2)	1.541357	3.956983	-11.7764	14.85911
(4 2) vs (0 2)	2.916568	5.446996	-15.41602	21.24916
(5 1) vs (0 2)	5.836875	4.534769	-9.425493	21.09924
(5 2) vs (0 2)	2.513008	4.953613	-14.15904	19.18505
(6 1) vs (0 2)	2.679707	3.699834	-9.772578	15.13199
(6 2) vs (0 2)	3.354161	3.745936	-9.253284	15.96161
(1 2) vs (1 1)	6.743589	1.956571	.1584881	13.32869
(2 1) vs (1 1)	3.804274	1.444387	-1.057004	8.665552
(2 2) vs (1 1)	6.773748	1.426616	1.972282	11.57521
(3 1) vs (1 1)	6.306549	2.076598	-.6825173	13.29561
(3 2) vs (1 1)	2.030326	2.982639	-8.008142	12.06879
(4 1) vs (1 1)	2.740184	2.104407	-4.34248	9.822848
(4 2) vs (1 1)	4.115394	4.345994	-10.51163	18.74242
(5 1) vs (1 1)	7.035701	3.050946	-3.232665	17.30407
(5 2) vs (1 1)	3.711834	3.697598	-8.732926	16.15659
(6 1) vs (1 1)	3.878533	1.584367	-1.453865	9.210932
(6 2) vs (1 1)	4.552988	1.739017	-1.299907	10.40588
(2 1) vs (1 2)	-2.939315	1.584686	-8.272786	2.394156
(2 2) vs (1 2)	.0301587	1.555266	-5.204295	5.264613
(3 1) vs (1 2)	-.4370403	2.191344	-7.8123	6.938219
(3 2) vs (1 2)	-4.713263	3.043014	-14.95493	5.528407
(4 1) vs (1 2)	-4.003405	2.225154	-11.49246	3.485648
(4 2) vs (1 2)	-2.628195	4.390534	-17.40512	12.14873
(5 1) vs (1 2)	.2921124	3.139176	-10.2732	10.85743
(5 2) vs (1 2)	-3.031755	3.748427	-15.64758	9.584075
(6 1) vs (1 2)	-2.865056	1.727787	-8.680154	2.950043
(6 2) vs (1 2)	-2.190601	1.846984	-8.406871	4.025668
(2 2) vs (2 1)	2.969474	.8277834	.1834585	5.755489
(3 1) vs (2 1)	2.502275	1.737839	-3.346654	8.351204
(3 2) vs (2 1)	-1.773948	2.74541	-11.01399	7.466097
(4 1) vs (2 1)	-1.06409	1.776062	-7.041662	4.913482
(4 2) vs (2 1)	.3111203	4.188733	-13.78662	14.40886
(5 1) vs (2 1)	3.231428	2.8367	-6.315864	12.77872
(5 2) vs (2 1)	-.0924394	3.51037	-11.90706	11.72218
(6 1) vs (2 1)	.0742597	1.100005	-3.627953	3.776472
(6 2) vs (2 1)	.7487139	1.295087	-3.610075	5.107502
(3 1) vs (2 2)	-.467199	1.7251	-6.273253	5.338855
(3 2) vs (2 2)	-4.743422	2.720059	-13.89814	4.411301
(4 1) vs (2 2)	-4.033564	1.767998	-9.983998	1.91687
(4 2) vs (2 2)	-2.658354	4.167677	-16.68523	11.36852
(5 1) vs (2 2)	.2619536	2.83367	-9.275142	9.799049
(5 2) vs (2 2)	-3.061913	3.488318	-14.80231	8.678485
(6 1) vs (2 2)	-2.895214	1.076673	-6.518899	.7284708
(6 2) vs (2 2)	-2.22076	1.250583	-6.429765	1.988245
(3 2) vs (3 1)	-4.276223	3.117614	-14.76897	6.216521
(4 1) vs (3 1)	-3.566365	2.312946	-11.35089	4.218163
(4 2) vs (3 1)	-2.191155	4.453535	-17.18012	12.79781
(5 1) vs (3 1)	.7291527	3.197868	-10.0337	11.492
(5 2) vs (3 1)	-2.594714	3.823289	-15.4625	10.27308
(6 1) vs (3 1)	-2.428015	1.854088	-8.668195	3.812165
(6 2) vs (3 1)	-1.753561	1.991237	-8.455334	4.948212
(4 1) vs (3 2)	.7098577	3.162201	-9.93295	11.35267
(4 2) vs (3 2)	2.085068	4.910167	-14.44075	18.61089
(5 1) vs (3 2)	5.005375	3.861317	-7.990401	18.00115
(5 2) vs (3 2)	1.681508	4.351701	-12.96472	16.32774
(6 1) vs (3 2)	1.848207	2.832163	-7.683816	11.38023
(6 2) vs (3 2)	2.522662	2.894598	-7.219493	12.26482

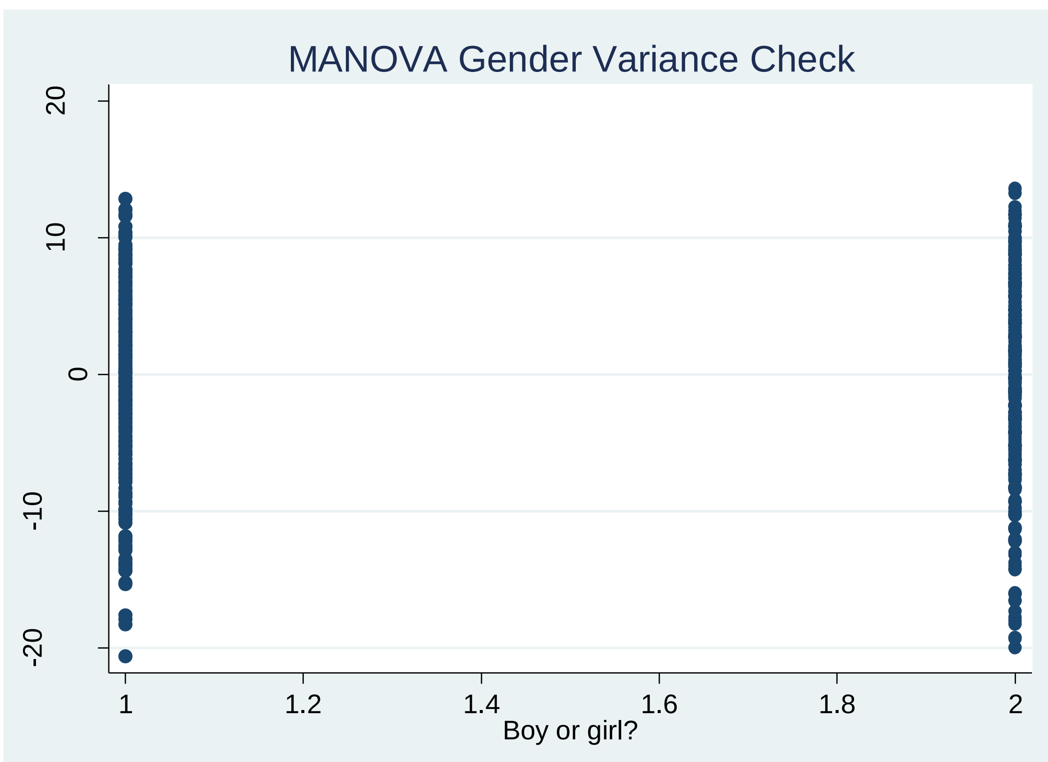
(4 2) vs (4 1)	1.37521	4.470665	-13.67141	16.42183
(5 1) vs (4 1)	4.295518	3.212268	-6.5158	15.10683
(5 2) vs (4 1)	.9716505	3.843467	-11.96405	13.90735
(6 1) vs (4 1)	1.13835	1.885385	-5.207165	7.483864
(6 2) vs (4 1)	1.812804	2.028321	-5.013782	8.63939
(5 1) vs (4 2)	2.920307	4.989432	-13.87229	19.7129
(5 2) vs (4 2)	-.4035597	5.36596	-18.46341	17.6563
(6 1) vs (4 2)	-.2368606	4.244621	-14.5227	14.04898
(6 2) vs (4 2)	.4375937	4.281589	-13.97267	14.84785
(5 2) vs (5 1)	-3.323867	4.475888	-18.38806	11.74033
(6 1) vs (5 1)	-3.157168	2.904295	-12.93196	6.617622
(6 2) vs (5 1)	-2.482714	3.002923	-12.58945	7.624022
(6 1) vs (5 2)	.1666991	3.577599	-11.87419	12.20759
(6 2) vs (5 2)	.8411534	3.624944	-11.35908	13.04138
(6 2) vs (6 1)	.6744543	1.486211	-4.327587	5.676495

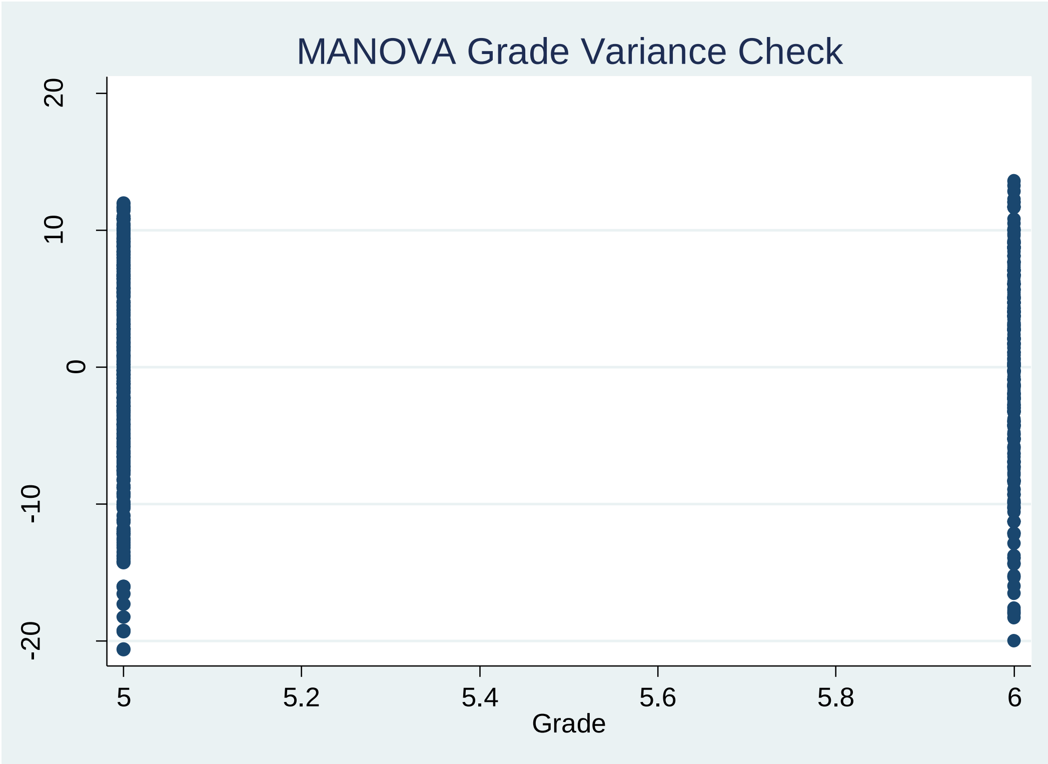
Random Sample MANOVA

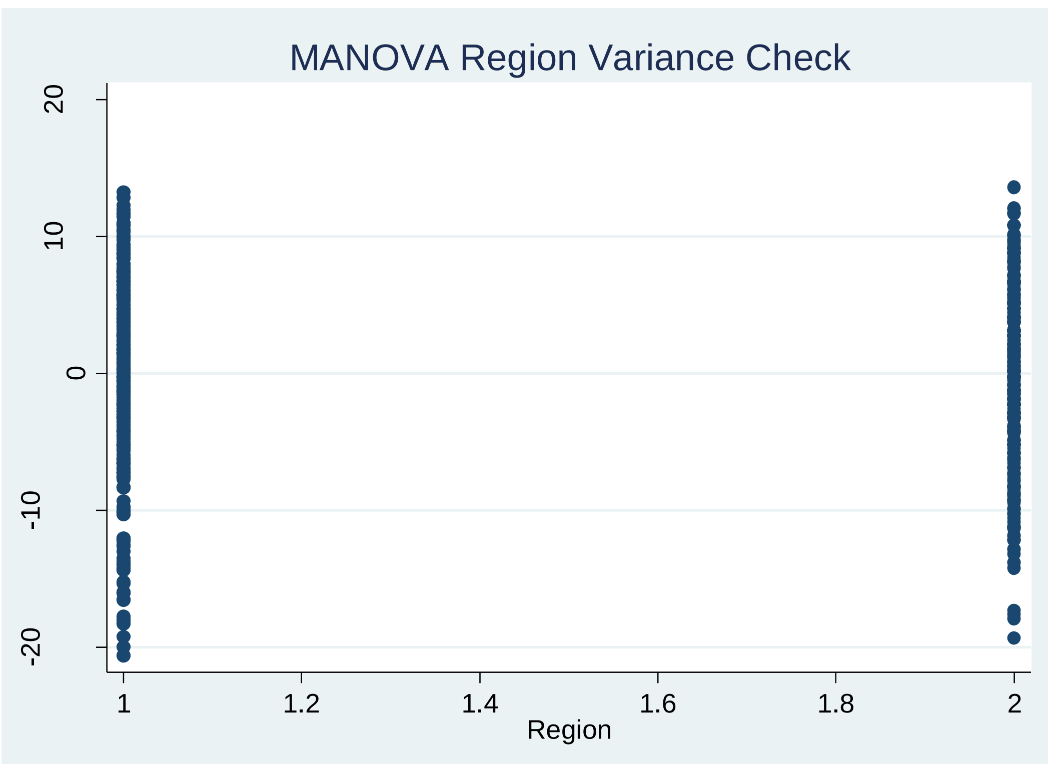
```
. manova selfperception enjoyment = Grade Boyorgirl Ethnicity Region Boyorgirl#Ethnicity Region#Grade Region#Ethnicity

                           Number of obs =      707

                           W = Wilks' lambda      L = Lawley-Hotelling trace
                           P = Pillai's trace     R = Roy's largest root

                  Source | Statistic     df   F(df1,    df2) =   F   Prob>F
     --------------------+--------------------------------------------------
                   Model | W   0.8119     21    42.0  1368.0     3.58 0.0000 e
                         | P   0.1947           42.0  1370.0     3.52 0.0000 a
                         | L   0.2236           42.0  1366.0     3.64 0.0000 a
                         | R   0.1781           21.0   685.0     5.81 0.0000 u
                         |--------------------------------------------------
                Residual |              685
     --------------------+--------------------------------------------------
                   Grade | W   0.9829      1     2.0   684.0     5.94 0.0028 e
                         | P   0.0171            2.0   684.0     5.94 0.0028 e
                         | L   0.0174            2.0   684.0     5.94 0.0028 e
                         | R   0.0174            2.0   684.0     5.94 0.0028 e
                         |--------------------------------------------------
               Boyorgirl | W   0.9984      1     2.0   684.0     0.54 0.5816 e
                         | P   0.0016            2.0   684.0     0.54 0.5816 e
                         | L   0.0016            2.0   684.0     0.54 0.5816 e
                         | R   0.0016            2.0   684.0     0.54 0.5816 e
                         |--------------------------------------------------
               Ethnicity | W   0.9867      6    12.0  1368.0     0.77 0.6843 e
                         | P   0.0134           12.0  1370.0     0.77 0.6835 a
                         | L   0.0135           12.0  1366.0     0.77 0.6851 a
                         | R   0.0091            6.0   685.0     1.04 0.3988 u
                         |--------------------------------------------------
                  Region | W   0.9983      1     2.0   684.0     0.60 0.5497 e
                         | P   0.0017            2.0   684.0     0.60 0.5497 e
                         | L   0.0018            2.0   684.0     0.60 0.5497 e
                         | R   0.0018            2.0   684.0     0.60 0.5497 e
                         |--------------------------------------------------
     Boyorgirl#Ethnicity | W   0.9611      6    12.0  1368.0     2.28 0.0071 e
                         | P   0.0393           12.0  1370.0     2.29 0.0071 a
                         | L   0.0401           12.0  1366.0     2.28 0.0072 a
                         | R   0.0245            6.0   685.0     2.79 0.0109 u
                         |--------------------------------------------------
            Region#Grade | W   0.9576      1     2.0   684.0    15.13 0.0000 e
                         | P   0.0424            2.0   684.0    15.13 0.0000 e
                         | L   0.0442            2.0   684.0    15.13 0.0000 e
                         | R   0.0442            2.0   684.0    15.13 0.0000 e
                         |--------------------------------------------------
        Region#Ethnicity | W   0.9765      5    10.0  1368.0     1.64 0.0911 e
                         | P   0.0235           10.0  1370.0     1.63 0.0921 a
                         | L   0.0240           10.0  1366.0     1.64 0.0902 a
                         | R   0.0214            5.0   685.0     2.93 0.0126 u
                         |--------------------------------------------------
                Residual |              685
     --------------------+--------------------------------------------------
                   Total |              706
     --------------------+--------------------------------------------------
                           e = exact, a = approximate, u = upper bound on F
```

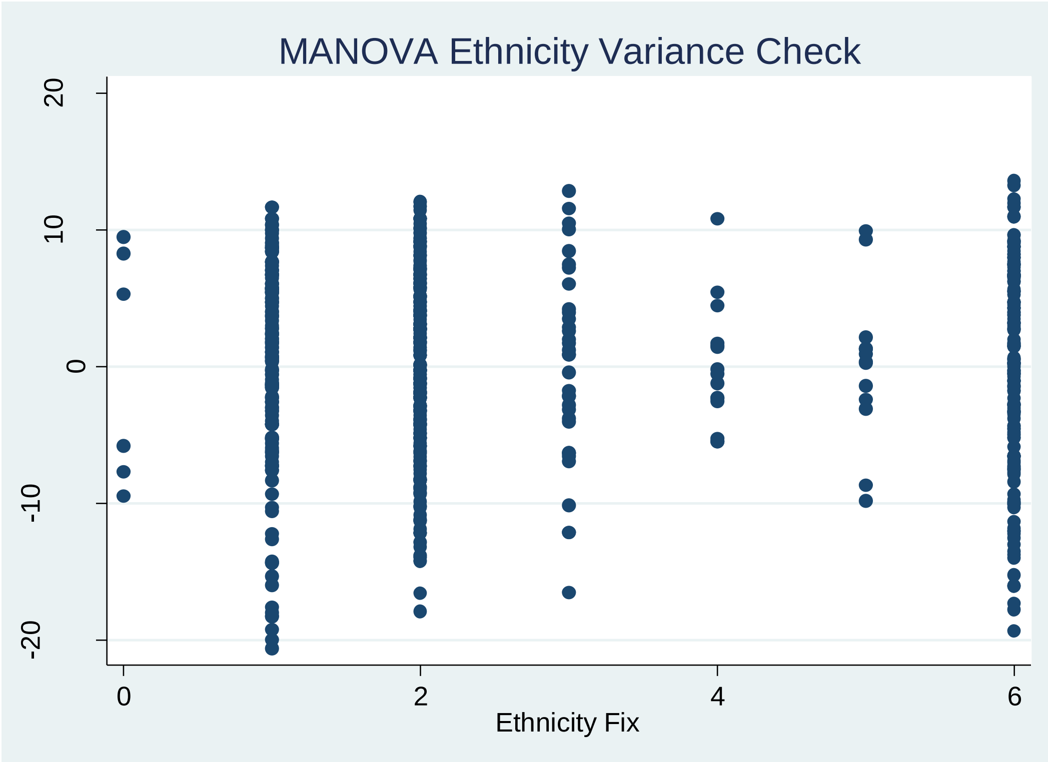
Random Sample MANOVA Assumptions Check

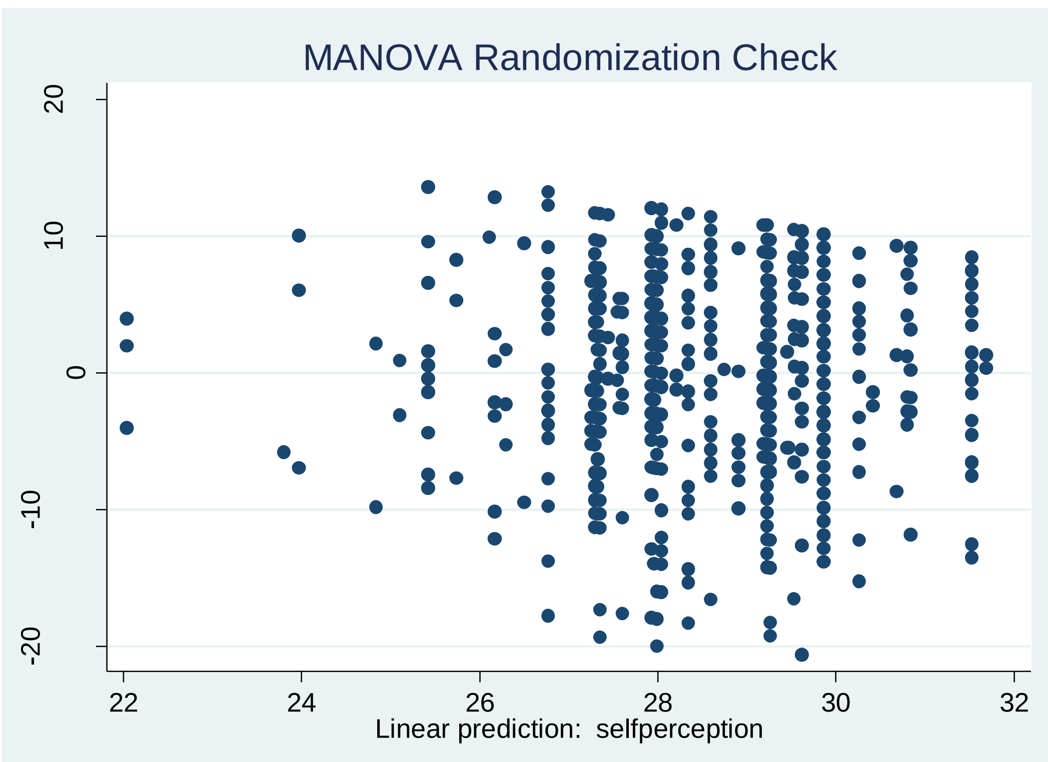


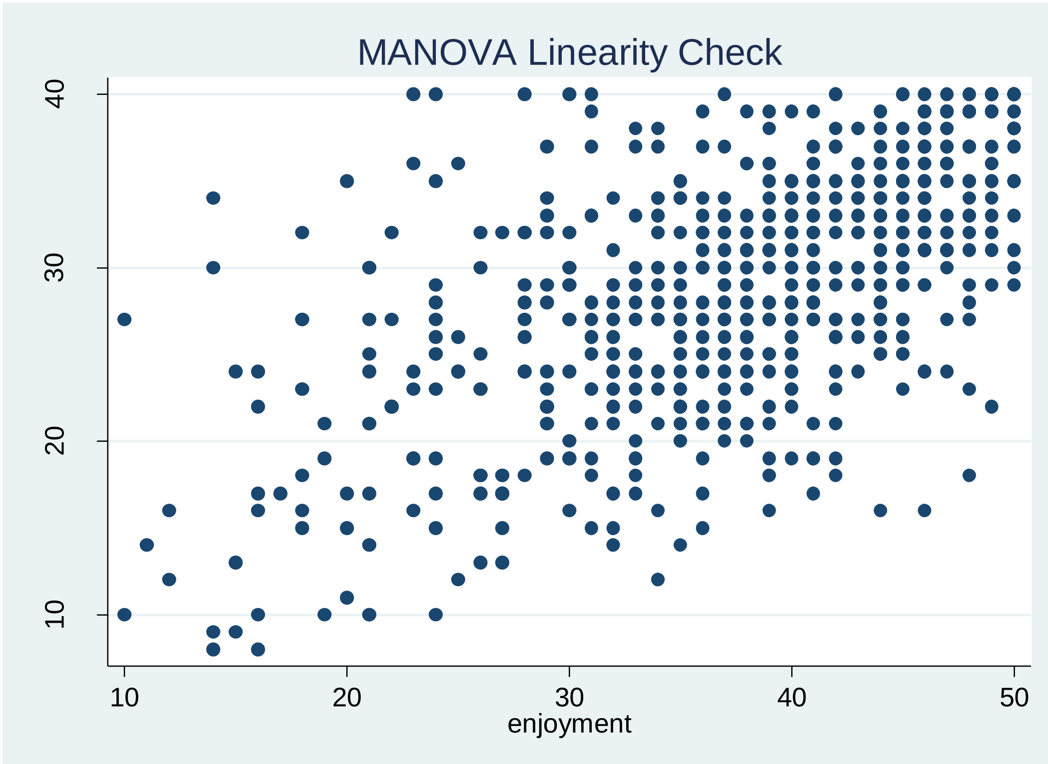



MANOVA Grade Variance Check
20
10
0
-10
-20
5
5.2
5.4
5.6
5.8
6
Grade


MANOVA Region Variance Check
20
10
0
-10
-20
1
1.2
1.4
1.6
1.8
2
Region


MANOVA Ethnicity Variance Check
20
10
0
-10
-20
0
2
4
6
Ethnicity Fix

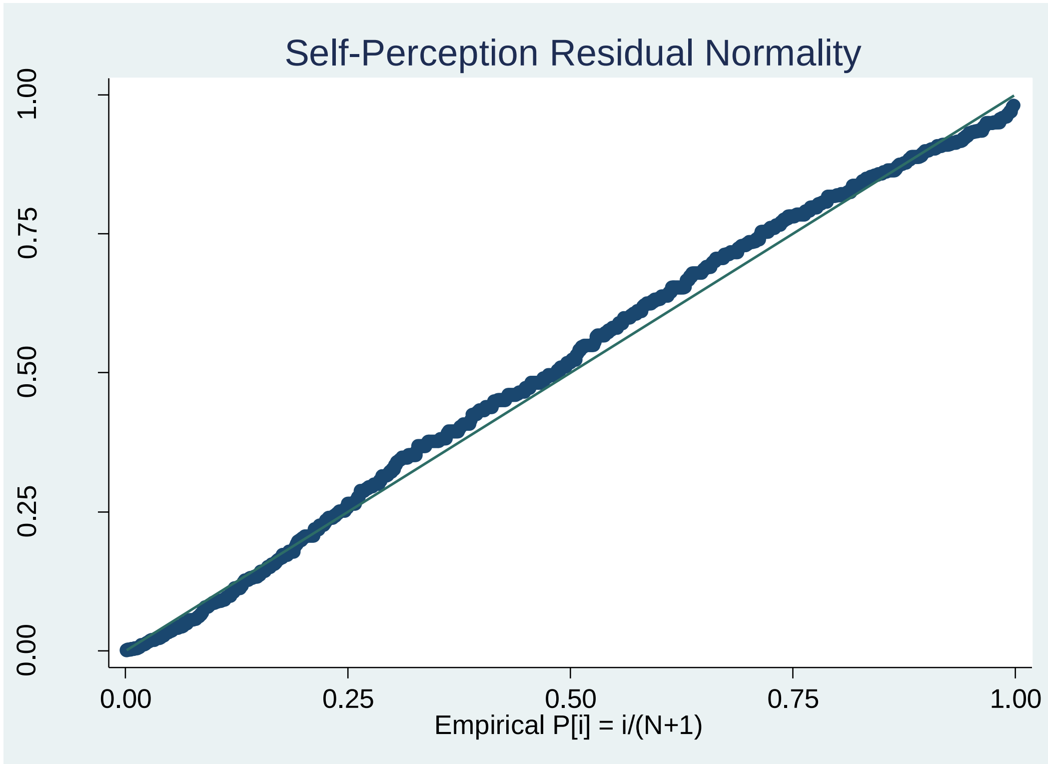

MANOVA Randomization Check
20
10
0
-10
-20
22
24
26
28
30
32
Linear prediction: selfperception

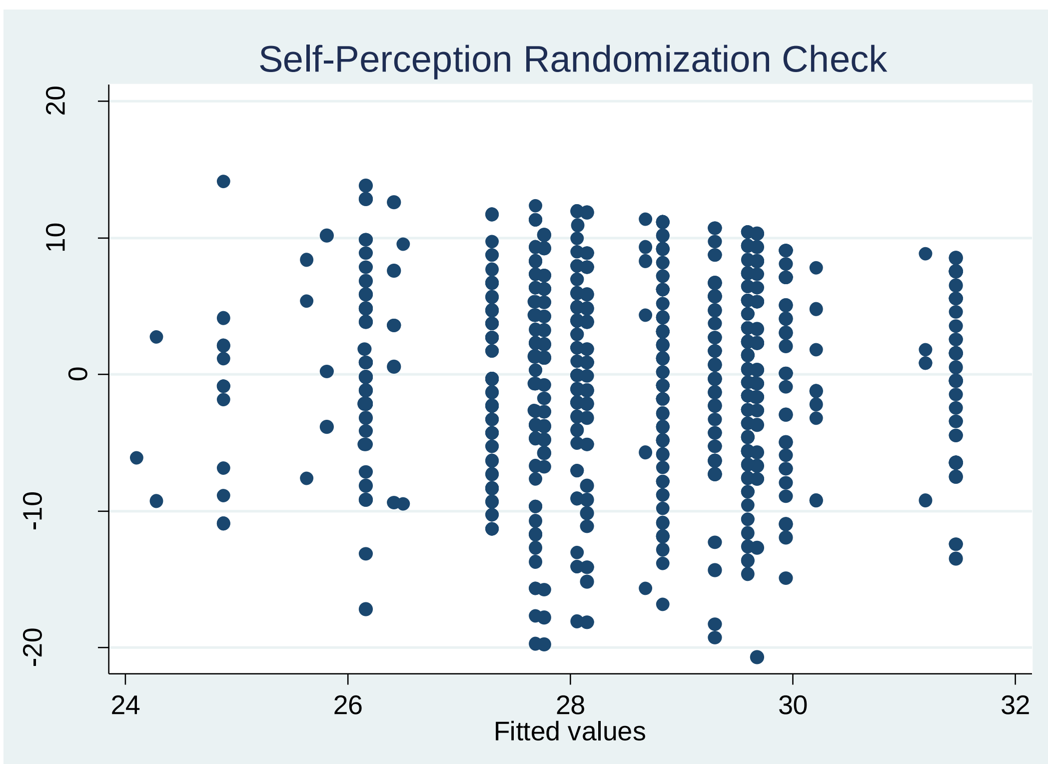


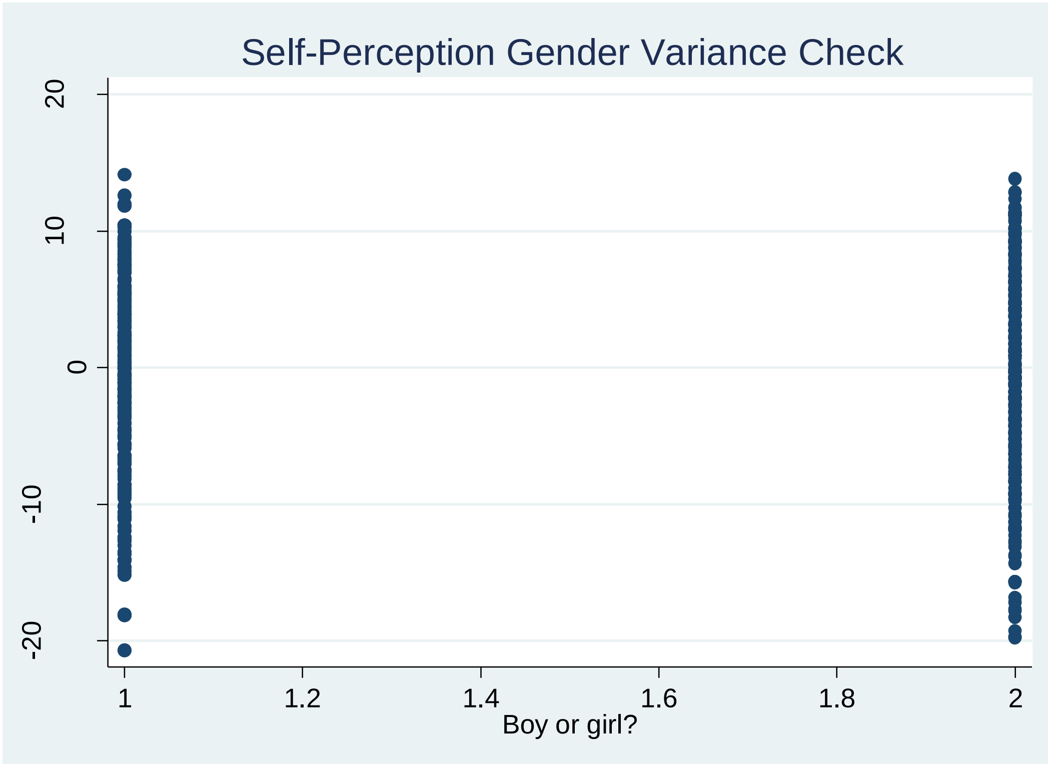
Random Sample Self-Perception ANOVA

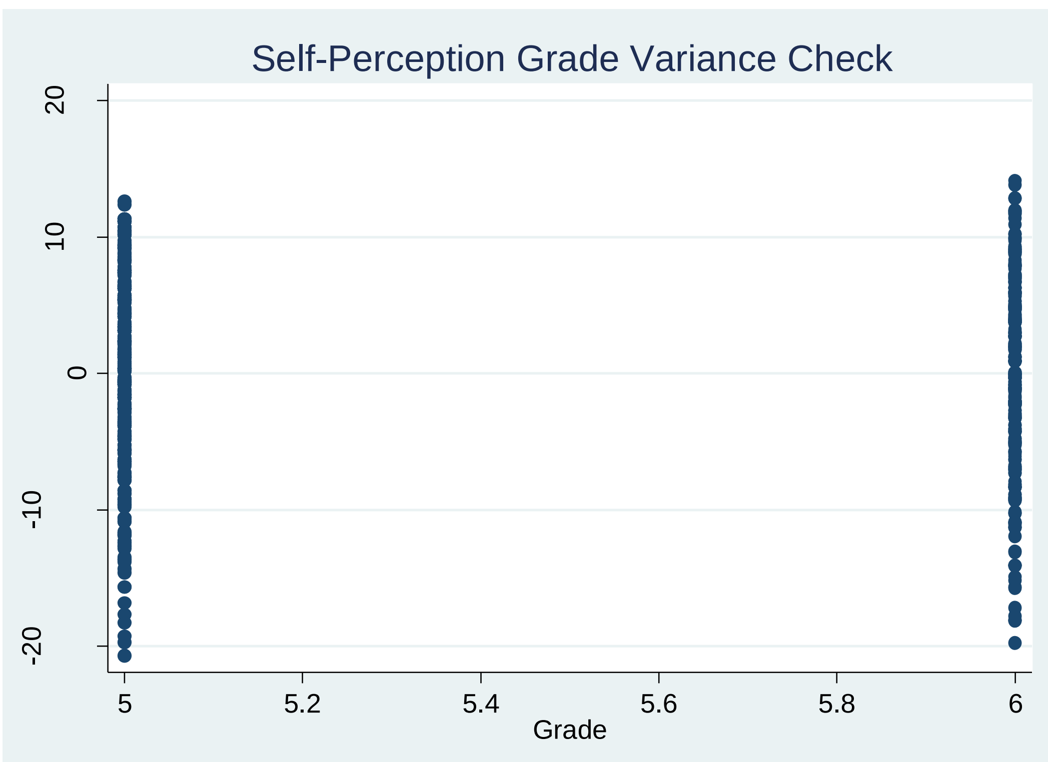
```
. anova selfperception Boyorgirl Grade Ethnicity Boyorgirl#Ethnicity, dropemptycells

                           Number of obs =       722     R-squared     =  0.0411
                           Root MSE      = 6.90326     Adj R-squared =  0.0221

                  Source | Partial SS    df       MS           F     Prob > F
     --------------------+----------------------------------------------------
                   Model | 1443.97607    14  103.141148       2.16     0.0078
                         |
               Boyorgirl | 19.4582816     1  19.4582816       0.41     0.5230
                   Grade |  409.75622     1   409.75622       8.60     0.0035
               Ethnicity | 122.555902     6  20.4259836       0.43     0.8601
     Boyorgirl#Ethnicity | 619.789162     6  103.298194       2.17     0.0443
                         |
                Residual | 33692.1237   707  47.6550547
     --------------------+----------------------------------------------------
                   Total | 35136.0997   721  48.7324545
```

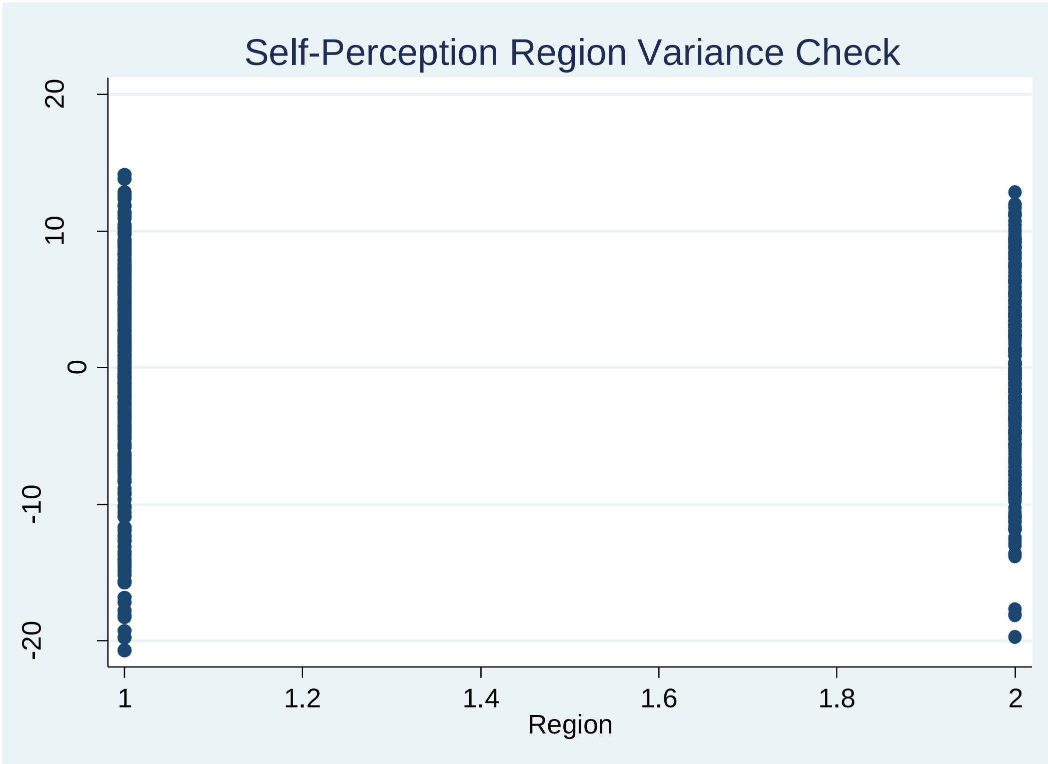
Random Sample Self-Perception ANOVA Assumptions Check

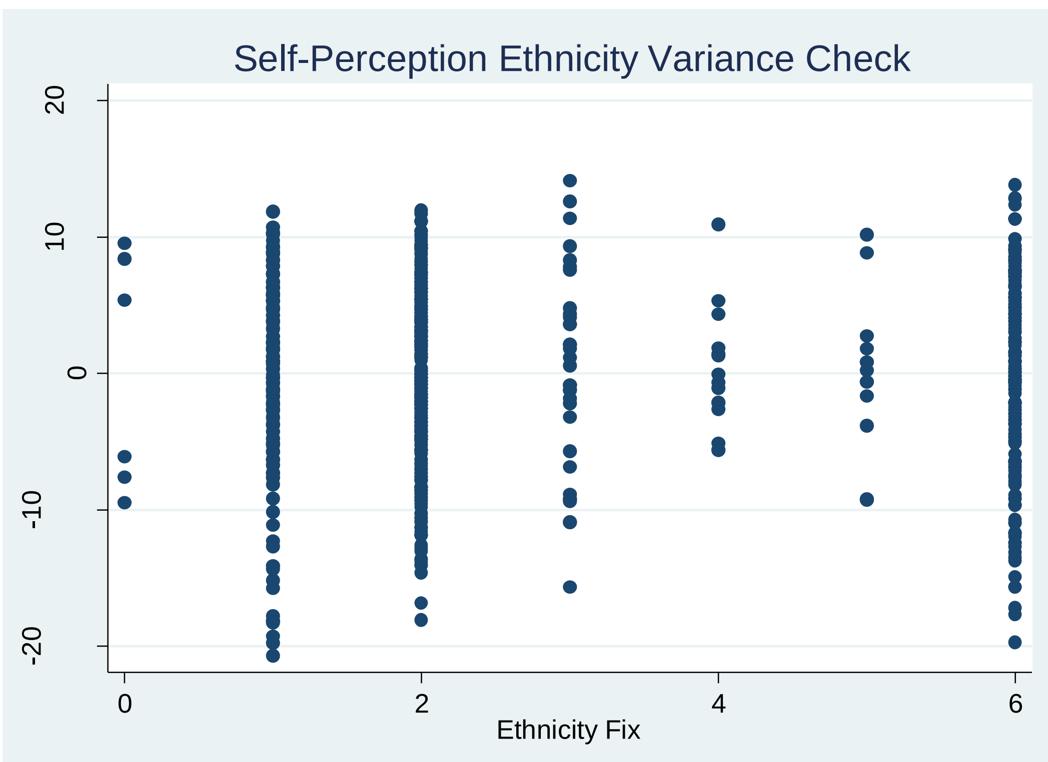





Self-Perception Gender Variance Check
20
10
0
-10
-20
1
1.2
1.4
1.6
1.8
2
Boy or girl?


Self-Perception Grade Variance Check
20
10
0
-10
-20
5
5.2
5.4
5.6
5.8
6
Grade


Self-Perception Region Variance Check
20
10
0
-10
-20
1
1.2
1.4
1.6
1.8
2
Region


Self-Perception Ethnicity Variance Check
20
10
0
-10
-20
0
2
4
6
Ethnicity Fix

Random Sample Self-Perception Contrasts

Ethnicity Codes: 0 – No Response, 1 – White, 2 – Hispanic, 3 – Black, 4 – Asian and Pacific Islander, 5 – Native American and Alaska Native, 6 - Multiracial

Gender Codes: 1 – Boy, 2 - Girl

```
. pwcompare Grade Boyorgirl#Ethnicity, mcompare(tukey)

Pairwise comparisons of marginal linear predictions

Margins      : asbalanced
```

	Number of Comparisons
Grade	1
Boyorgirl#Ethnicity	91

	Contrast	Std. Err.	Tukey [95% Conf.	Interval]
Grade				
6 vs 5	-1.530476	.5219371	-2.555208	-.5057436
Boyorgirl#Ethnicity				
(1 1) vs (1 0)	3.181265	4.95912	-13.50839	19.87092
(1 2) vs (1 0)	3.097173	4.91644	-13.44884	19.64319
(1 3) vs (1 0)	-.0844114	5.144241	-17.39708	17.22826
(1 4) vs (1 0)	1.180211	5.401513	-16.99829	19.35871
(1 5) vs (1 0)	4.698928	5.461018	-13.67983	23.07769
(1 6) vs (1 0)	4.96718	4.950346	-11.69294	21.6273

(2 0) vs (1 0)	-.8673811	5.979826	-20.99216	19.2574
(2 1) vs (1 0)	2.798312	4.948154	-13.85443	19.45106
(2 2) vs (1 0)	2.332102	4.91447	-14.20728	18.87149
(2 3) vs (1 0)	3.71219	5.200781	-13.79076	21.21514
(2 4) vs (1 0)	3.098571	5.64253	-15.89106	22.0882
(2 5) vs (1 0)	-.6878097	5.779457	-20.13826	18.76264
(2 6) vs (1 0)	1.189782	4.936722	-15.42449	17.80406
(1 2) vs (1 1)	-.0840924	.9934874	-3.427621	3.259436
(1 3) vs (1 1)	-3.265676	1.786994	-9.279707	2.748354
(1 4) vs (1 1)	-2.001054	2.445251	-10.23041	6.228307
(1 5) vs (1 1)	1.517663	2.578121	-7.158863	10.19419
(1 6) vs (1 1)	1.785915	1.145401	-2.06887	5.640701
(2 0) vs (1 1)	-4.048646	3.552499	-16.00439	7.907098
(2 1) vs (1 1)	-.382953	1.134708	-4.201751	3.435845
(2 2) vs (1 1)	-.8491634	.9792847	-4.144893	2.446566
(2 3) vs (1 1)	.5309252	1.965838	-6.084995	7.146846
(2 4) vs (1 1)	-.0826938	2.936696	-9.965987	9.800599
(2 5) vs (1 1)	-3.869075	3.196643	-14.6272	6.889054
(2 6) vs (1 1)	-1.991483	1.08746	-5.651271	1.668304
(1 3) vs (1 2)	-3.181584	1.68211	-8.842636	2.479468
(1 4) vs (1 2)	-1.916961	2.365418	-9.877648	6.043726
(1 5) vs (1 2)	1.601756	2.501361	-6.816439	10.01995
(1 6) vs (1 2)	1.870008	.9628246	-1.370327	5.110342
(2 0) vs (1 2)	-3.964554	3.495686	-15.7291	7.799988
(2 1) vs (1 2)	-.2988606	.95047	-3.497616	2.899895
(2 2) vs (1 2)	-.765071	.7575081	-3.314424	1.784282
(2 3) vs (1 2)	.6150177	1.864597	-5.660184	6.890219
(2 4) vs (1 2)	.0013986	2.871379	-9.662072	9.664869
(2 5) vs (1 2)	-3.784982	3.135399	-14.337	6.767036
(2 6) vs (1 2)	-1.907391	.8922885	-4.91034	1.095558
(1 4) vs (1 3)	1.264623	2.796217	-8.145894	10.67514
(1 5) vs (1 3)	4.78334	2.913947	-5.023393	14.59007
(1 6) vs (1 3)	5.051592	1.775451	-.9235939	11.02678
(2 0) vs (1 3)	-.7829697	3.804377	-13.5864	12.02046
(2 1) vs (1 3)	2.882723	1.768399	-3.068727	8.834174
(2 2) vs (1 3)	2.416513	1.673171	-3.214455	8.047481
(2 3) vs (1 3)	3.796602	2.388968	-4.243342	11.83655
(2 4) vs (1 3)	3.182983	3.234179	-7.701473	14.06744
(2 5) vs (1 3)	-.6033984	3.47292	-12.29132	11.08453
(2 6) vs (1 3)	1.274193	1.738985	-4.578266	7.126652
(1 5) vs (1 4)	3.518717	3.354579	-7.770939	14.80837
(1 6) vs (1 4)	3.786969	2.433531	-4.40295	11.97689
(2 0) vs (1 4)	-2.047592	4.149587	-16.0128	11.91762
(2 1) vs (1 4)	1.618101	2.428628	-6.555317	9.791518
(2 2) vs (1 4)	1.15189	2.359859	-6.790088	9.093869
(2 3) vs (1 4)	2.531979	2.910764	-7.264041	12.328
(2 4) vs (1 4)	1.91836	3.638455	-10.32667	14.16338
(2 5) vs (1 4)	-1.868021	3.850527	-14.82676	11.09072
(2 6) vs (1 4)	.0095701	2.406579	-8.089642	8.108782
(1 6) vs (1 5)	.2682519	2.566102	-8.367825	8.904328
(2 0) vs (1 5)	-5.566309	4.227872	-19.79499	8.662366
(2 1) vs (1 5)	-1.900616	2.561517	-10.52127	6.720032
(2 2) vs (1 5)	-2.366827	2.496321	-10.76806	6.034406
(2 3) vs (1 5)	-.9867381	3.02226	-11.15799	9.184515
(2 4) vs (1 5)	-1.600357	3.72876	-14.1493	10.94858
(2 5) vs (1 5)	-5.386738	3.935488	-18.63141	7.857934
(2 6) vs (1 5)	-3.509147	2.540425	-12.05881	5.040518
(2 0) vs (1 6)	-5.834561	3.542605	-17.75701	6.087884
(2 1) vs (1 6)	-2.168868	1.109184	-5.901768	1.564032
(2 2) vs (1 6)	-2.635079	.9491694	-5.829457	.5592999
(2 3) vs (1 6)	-1.25499	1.950478	-7.819217	5.309237
(2 4) vs (1 6)	-1.868609	2.927581	-11.72122	7.984006
(2 5) vs (1 6)	-5.65499	3.18722	-16.38141	5.071426
(2 6) vs (1 6)	-3.777399	1.059967	-7.344662	-.2101356
(2 1) vs (2 0)	3.665693	3.53937	-8.245868	15.57725
(2 2) vs (2 0)	3.199483	3.492359	-8.553863	14.95283
(2 3) vs (2 0)	4.579571	3.885473	-8.496777	17.65592
(2 4) vs (2 0)	3.965952	4.457948	-11.03703	18.96894
(2 5) vs (2 0)	.1795714	4.631512	-15.40753	15.76668
(2 6) vs (2 0)	2.057163	3.523881	-9.802269	13.91659

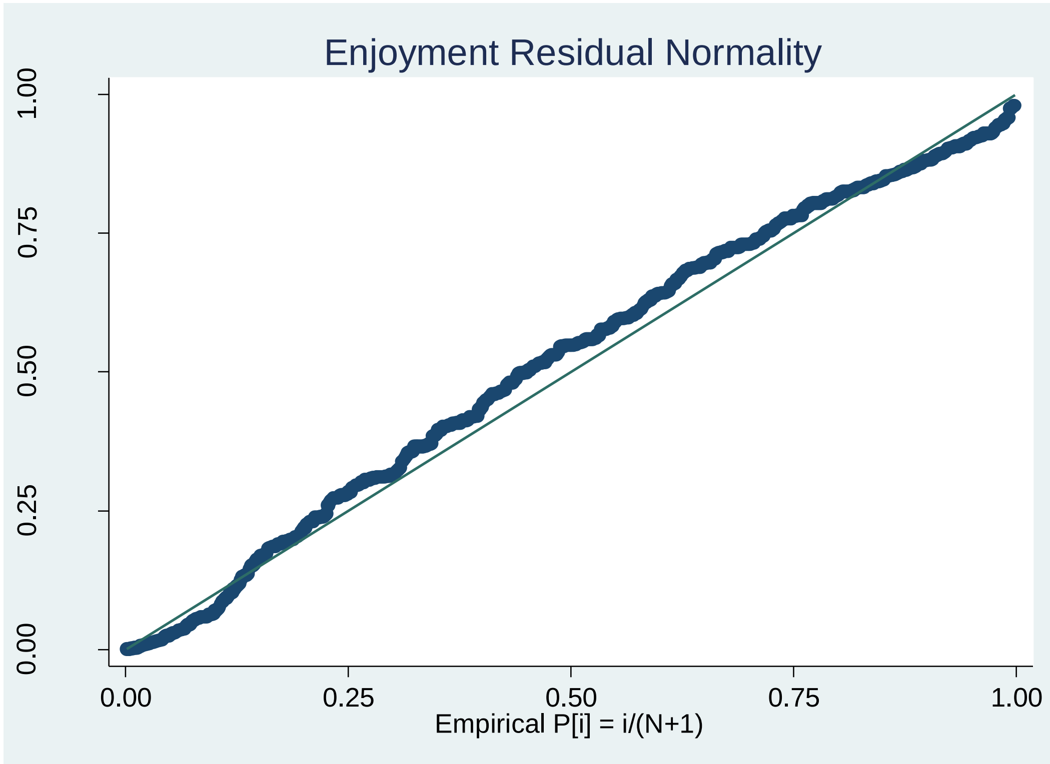
(2 2) vs (2 1)	-.4662104	.9365615	-3.618158	2.685737
(2 3) vs (2 1)	.9138783	1.944412	-5.629934	7.457691
(2 4) vs (2 1)	.3002592	2.923461	-9.53849	10.13901
(2 5) vs (2 1)	-3.486122	3.183511	-14.20006	7.227814
(2 6) vs (2 1)	-1.60853	1.048725	-5.137959	1.920898
(2 3) vs (2 2)	1.380089	1.857726	-4.871988	7.632165
(2 4) vs (2 2)	.7664696	2.86665	-8.881088	10.41403
(2 5) vs (2 2)	-3.019911	3.131318	-13.55819	7.518371
(2 6) vs (2 2)	-1.14232	.8776917	-4.096144	1.811504
(2 4) vs (2 3)	-.6136191	3.335002	-11.83739	10.61015
(2 5) vs (2 3)	-4.4	3.56483	-16.39724	7.597244
(2 6) vs (2 3)	-2.522409	1.916634	-8.972737	3.92792
(2 5) vs (2 4)	-3.786381	4.18046	-17.85549	10.28273
(2 6) vs (2 4)	-1.90879	2.905307	-11.68644	7.868864
(2 6) vs (2 5)	1.877591	3.166622	-8.779504	12.53469

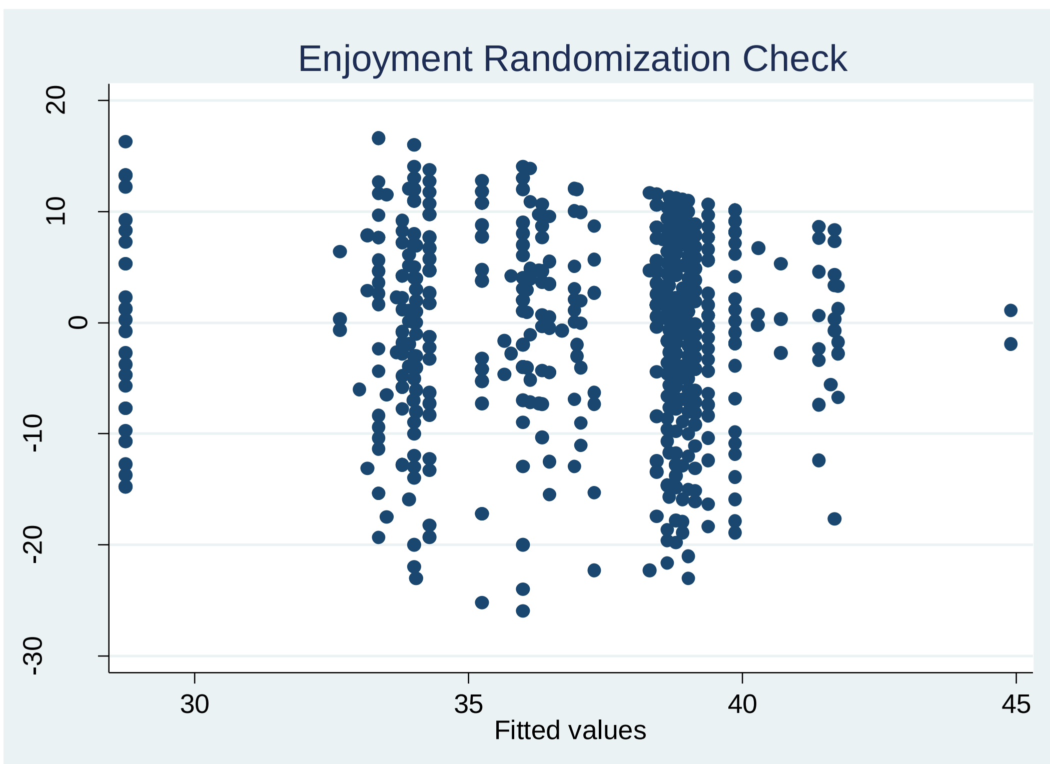
Random Sample Enjoyment ANOVA

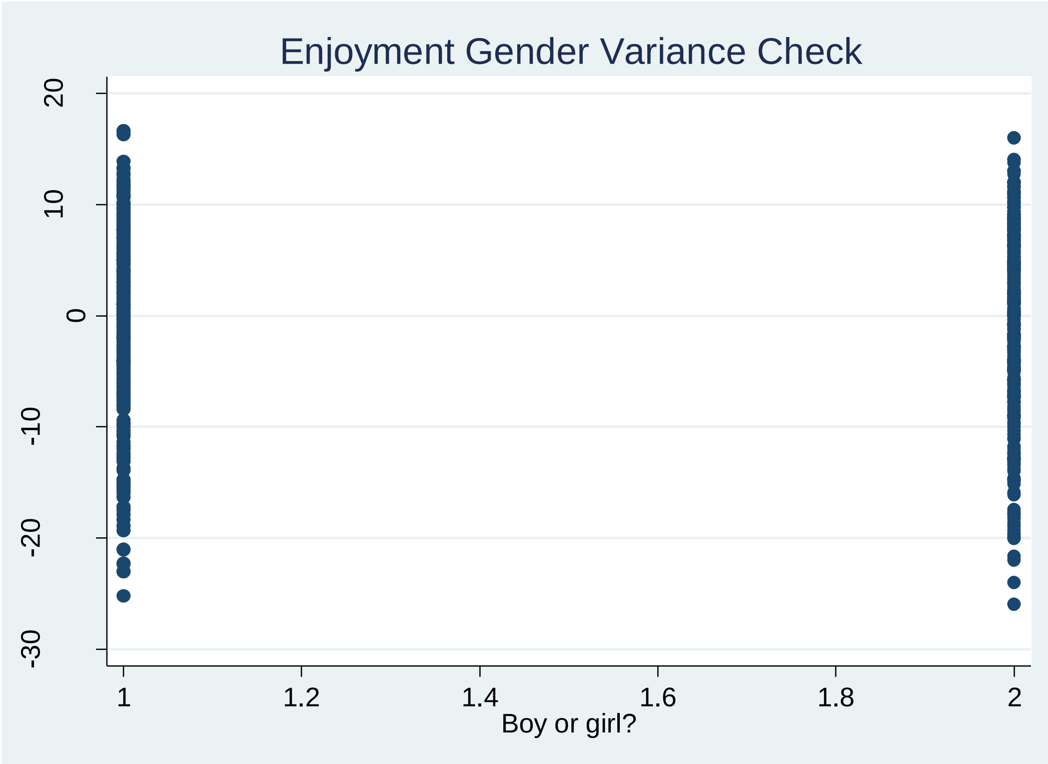
```
. anova enjoyment Boyorgirl Grade Region Ethnicity Boyorgirl#Ethnicity Grade#Region Region#Ethnicity, dropemptycells

                     Number of obs =        718    R-squared     =  0.1099
                     Root MSE      =    8.27333    Adj R-squared =  0.0830
```

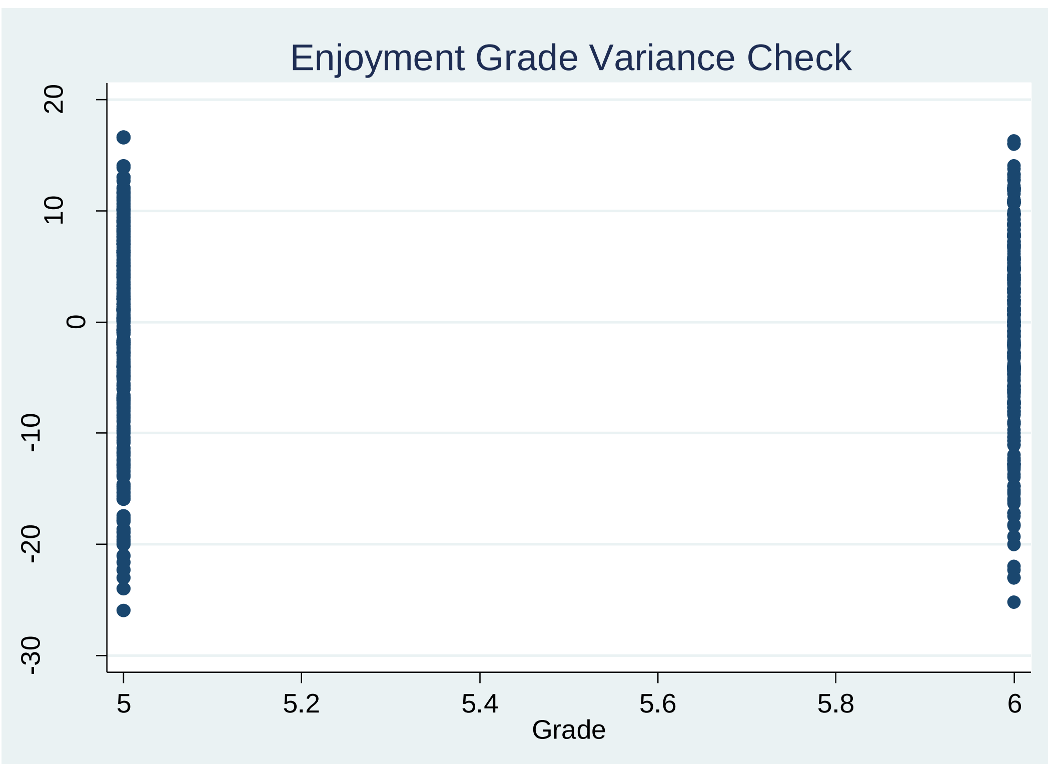
Source	Partial SS	df	MS	F	Prob > F
Model	5880.78292	21	280.037282	4.09	0.0000
Boyorgirl	3.03828326	1	3.03828326	0.04	0.8332
Grade	777.423218	1	777.423218	11.36	0.0008
Region	3.43716601	1	3.43716601	0.05	0.8228
Ethnicity	255.791953	6	42.6319921	0.62	0.7121
Boyorgirl#Ethnicity	1080.16108	6	180.026847	2.63	0.0158
Grade#Region	1061.80213	1	1061.80213	15.51	0.0001
Region#Ethnicity	862.465763	5	172.493153	2.52	0.0284
Residual	47639.841	696	68.4480475		
Total	53520.624	717	74.6452217		

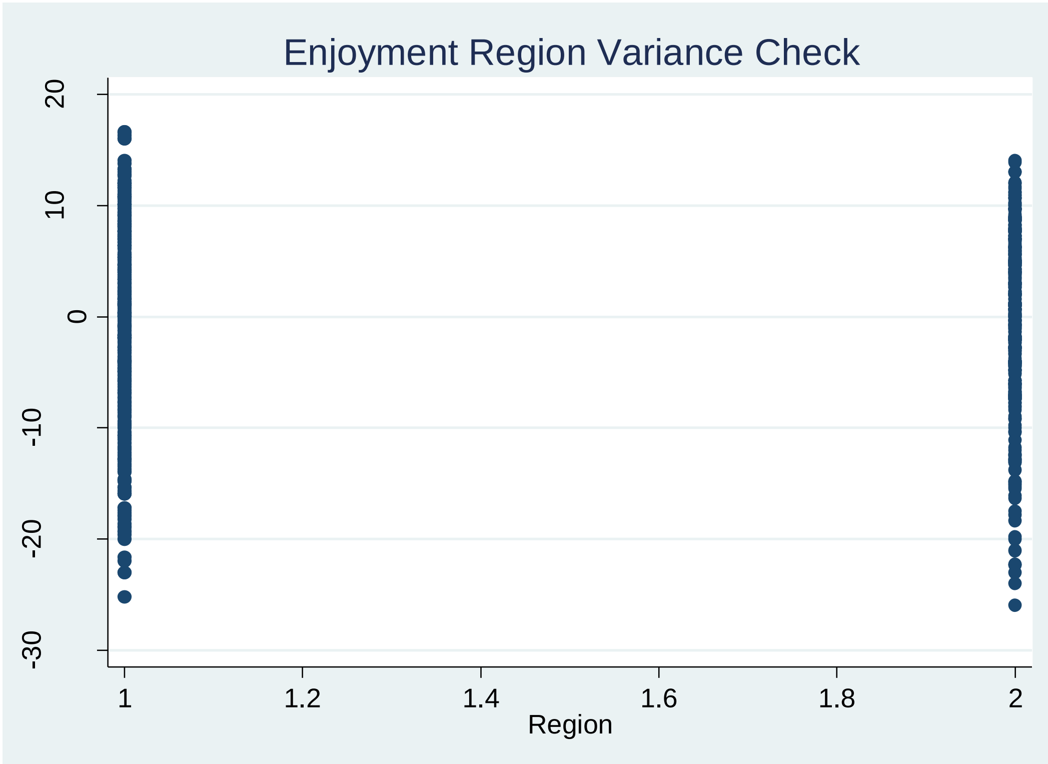
Random Sample Enjoyment ANOVA Assumptions Check



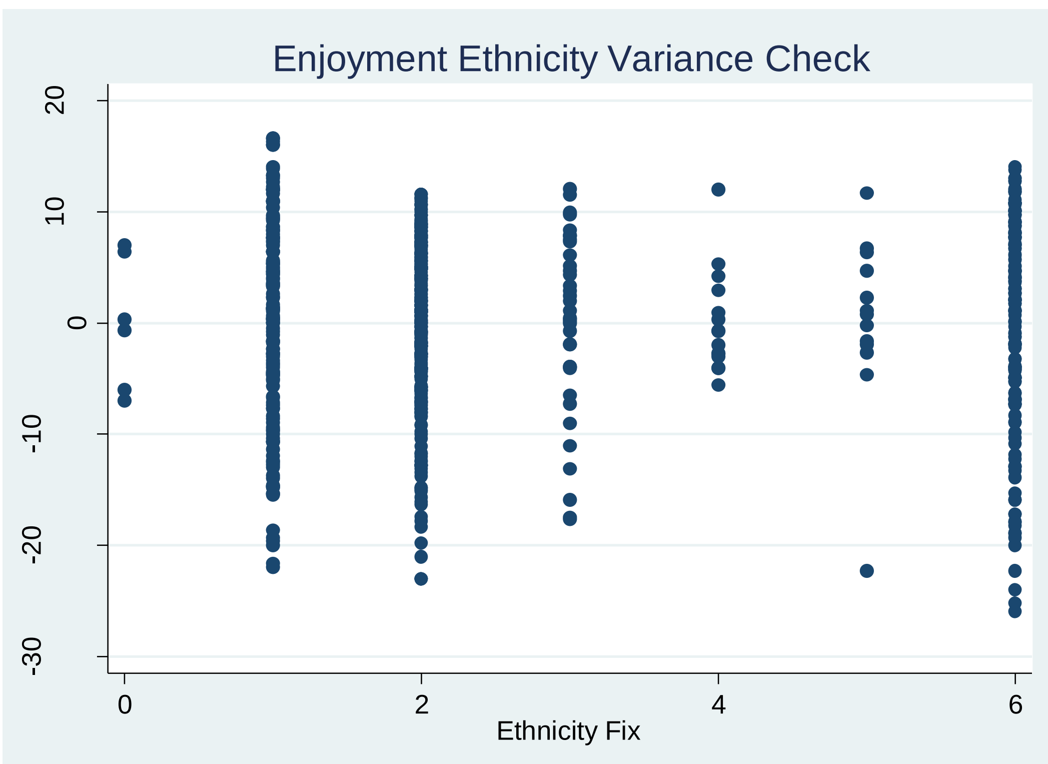



Enjoyment Gender Variance Check
20
10
0
-10
-20
-30
1
1.2
1.4
1.6
1.8
2
Boy or girl?


Enjoyment Grade Variance Check
20
10
0
-10
-20
-30
5
5.2
5.4
5.6
5.8
6
Grade



Enjoyment Region Variance Check
20
10
0
-10
-20
-30
1
1.2
1.4
1.6
1.8
2
Region



Enjoyment Ethnicity Variance Check
20
10
0
-10
-20
-30
0
2
4
6
Ethnicity Fix

Random Sample Enjoyment Contrasts

Ethnicity Codes: 0 – No Response, 1 – White, 2 – Hispanic, 3 – Black, 4 – Asian and Pacific Islander, 5 – Native American and Alaska Native, 6 - Multiracial

Gender Codes: 1 – Boy, 2 - Girl

```
. pwcompare Grade Boyorgirl#Ethnicity Grade#Region Ethnicity#Region, mcom
> pare(tukey)

Pairwise comparisons of marginal linear predictions

Margins      : asbalanced
```

	Number of Comparisons
Grade	1
Boyorgirl#Ethnicity	91
Grade#Region	6
Ethnicity#Region	91

	Contrast	Std. Err.	Tukey [95% Conf.	Interval]
Grade				
6 vs 5	-2.137681	.6342998	-3.383051	-.8923101
Boyorgirl#Ethnicity				
(1 1) vs (1 0)	.	(not estimable)		
(1 2) vs (1 0)	.	(not estimable)		
(1 3) vs (1 0)	.	(not estimable)		
(1 4) vs (1 0)	.	(not estimable)		
(1 5) vs (1 0)	.	(not estimable)		
(1 6) vs (1 0)	.	(not estimable)		
(2 0) vs (1 0)	-1.338965	7.168618	-25.4659	22.78797
(2 1) vs (1 0)	.	(not estimable)		
(2 2) vs (1 0)	.	(not estimable)		
(2 3) vs (1 0)	.	(not estimable)		
(2 4) vs (1 0)	.	(not estimable)		
(2 5) vs (1 0)	.	(not estimable)		
(2 6) vs (1 0)	.	(not estimable)		
(1 2) vs (1 1)	4.097586	1.287026	-.2340725	8.429245
(1 3) vs (1 1)	1.098244	2.19669	-6.295011	8.491499
(1 4) vs (1 1)	3.4951	3.265709	-7.496078	14.48628
(1 5) vs (1 1)	6.859192	3.121503	-3.646643	17.36503
(1 6) vs (1 1)	3.659446	1.499991	-1.388972	8.707864
(2 0) vs (1 1)	.	(not estimable)		
(2 1) vs (1 1)	5.268322	1.368828	.6613483	9.875295
(2 2) vs (1 1)	3.859247	1.269156	-.4122664	8.130761
(2 3) vs (1 1)	4.232876	2.53836	-4.310313	12.77606
(2 4) vs (1 1)	4.409359	3.647492	-7.866761	16.68548
(2 5) vs (1 1)	2.238541	3.889626	-10.85251	15.3296
(2 6) vs (1 1)	2.703927	1.38095	-1.943845	7.3517
(1 3) vs (1 2)	-2.999342	2.034615	-9.847108	3.848424
(1 4) vs (1 2)	-.6024858	3.152897	-11.21398	10.00901
(1 5) vs (1 2)	2.761606	3.006371	-7.356736	12.87995
(1 6) vs (1 2)	-.4381396	1.246613	-4.633781	3.757502
(2 0) vs (1 2)	.	(not estimable)		
(2 1) vs (1 2)	1.170736	1.270153	-3.104134	5.445605
(2 2) vs (1 2)	-.2383386	.9112337	-3.305217	2.82854
(2 3) vs (1 2)	.1352896	2.393077	-7.918929	8.189509
(2 4) vs (1 2)	.3117733	3.547967	-11.62938	12.25293
(2 5) vs (1 2)	-1.859045	3.796386	-14.63629	10.9182
(2 6) vs (1 2)	-1.393659	1.09832	-5.0902	2.302883

(1 4) vs (1 3)	2.396856	3.622441	-9.794953	14.58867
(1 5) vs (1 3)	5.760948	3.49569	-6.004262	17.52616
(1 6) vs (1 3)	2.561202	2.178253	-4.77	9.892405
(2 0) vs (1 3)	.	(not estimable)		
(2 1) vs (1 3)	4.170078	2.191287	-3.204992	11.54515
(2 2) vs (1 3)	2.761003	2.025116	-4.054796	9.576803
(2 3) vs (1 3)	3.134632	2.830091	-6.390417	12.65968
(2 4) vs (1 3)	3.311115	3.967403	-10.04171	16.66394
(2 5) vs (1 3)	1.140297	4.192275	-12.96936	15.24996
(2 6) vs (1 3)	1.605683	2.09446	-5.443502	8.654869
(1 5) vs (1 4)	3.364092	4.242986	-10.91624	17.64443
(1 6) vs (1 4)	.1643461	3.247193	-10.76451	11.09321
(2 0) vs (1 4)	.	(not estimable)		
(2 1) vs (1 4)	1.773221	3.2574	-9.189993	12.73644
(2 2) vs (1 4)	.3641472	3.148394	-10.23219	10.96049
(2 3) vs (1 4)	.7377753	3.83163	-12.15809	13.63364
(2 4) vs (1 4)	.9142591	4.39526	-13.87857	15.70709
(2 5) vs (1 4)	-1.256559	4.831379	-17.51721	15.00409
(2 6) vs (1 4)	-.7911728	3.190629	-11.52966	9.947313
(1 6) vs (1 5)	-3.199746	3.104067	-13.6469	7.247405
(2 0) vs (1 5)	.	(not estimable)		
(2 1) vs (1 5)	-1.59087	3.113953	-12.0713	8.889555
(2 2) vs (1 5)	-2.999944	3.00024	-13.09765	7.097764
(2 3) vs (1 5)	-2.626316	3.714421	-15.1277	9.875063
(2 4) vs (1 5)	-2.449833	4.544276	-17.7442	12.84453
(2 5) vs (1 5)	-4.620651	4.740917	-20.57684	11.33554
(2 6) vs (1 5)	-4.155264	3.046776	-14.4096	6.099068
(2 0) vs (1 6)	.	(not estimable)		
(2 1) vs (1 6)	1.608875	1.484114	-3.386109	6.603859
(2 2) vs (1 6)	.1998011	1.229244	-3.937384	4.336986
(2 3) vs (1 6)	.5734292	2.513844	-7.887248	9.034106
(2 4) vs (1 6)	.749913	3.633326	-11.47853	12.97836
(2 5) vs (1 6)	-1.420905	3.875737	-14.46522	11.6234
(2 6) vs (1 6)	-.9555189	1.310842	-5.367332	3.456294
(2 1) vs (2 0)	.	(not estimable)		
(2 2) vs (2 0)	.	(not estimable)		
(2 3) vs (2 0)	.	(not estimable)		
(2 4) vs (2 0)	.	(not estimable)		
(2 5) vs (2 0)	.	(not estimable)		
(2 6) vs (2 0)	.	(not estimable)		
(2 2) vs (2 1)	-1.409074	1.252539	-5.624662	2.806513
(2 3) vs (2 1)	-1.035446	2.52654	-9.538852	7.46796
(2 4) vs (2 1)	-.8589624	3.64224	-13.11741	11.39948
(2 5) vs (2 1)	-3.029781	3.884086	-16.10219	10.04263
(2 6) vs (2 1)	-2.564394	1.364665	-7.157357	2.028568
(2 3) vs (2 2)	.3736281	2.385588	-7.655387	8.402643
(2 4) vs (2 2)	.5501119	3.544284	-11.37865	12.47887
(2 5) vs (2 2)	-1.620706	3.792699	-14.38554	11.14413
(2 6) vs (2 2)	-1.15532	1.080528	-4.791979	2.481339
(2 4) vs (2 3)	.1764838	4.16471	-13.8404	14.19337
(2 5) vs (2 3)	-1.994335	4.377876	-16.72866	12.73999
(2 6) vs (2 3)	-1.528948	2.443351	-9.75237	6.694474
(2 5) vs (2 4)	-2.170818	5.096231	-19.32286	14.98123
(2 6) vs (2 4)	-1.705432	3.581507	-13.75947	10.34861
(2 6) vs (2 5)	.4653864	3.827846	-12.41774	13.34851
Grade#Region				
(5 2) vs (5 1)	.	(not estimable)		
(6 1) vs (5 1)	-4.631221	.8703818	-6.87267	-2.389772
(6 2) vs (5 1)	.	(not estimable)		
(6 1) vs (5 2)	.	(not estimable)		
(6 2) vs (5 2)	.3558597	.9212761	-2.016655	2.728374
(6 2) vs (6 1)	.	(not estimable)		

Ethnicity#Region				
(0 2) vs (0 1)	.	(not estimable)		
(1 1) vs (0 1)	.	(not estimable)		
(1 2) vs (0 1)	.	(not estimable)		
(2 1) vs (0 1)	.	(not estimable)		
(2 2) vs (0 1)	.	(not estimable)		
(3 1) vs (0 1)	.	(not estimable)		
(3 2) vs (0 1)	.	(not estimable)		
(4 1) vs (0 1)	.	(not estimable)		
(4 2) vs (0 1)	.	(not estimable)		
(5 1) vs (0 1)	.	(not estimable)		
(5 2) vs (0 1)	.	(not estimable)		
(6 1) vs (0 1)	.	(not estimable)		
(6 2) vs (0 1)	.	(not estimable)		
(1 1) vs (0 2)	.1845705	3.681005	-12.20434	12.57348
(1 2) vs (0 2)	5.437438	3.88502	-7.638114	18.51299
(2 1) vs (0 2)	2.732009	3.696819	-9.710128	15.17415
(2 2) vs (0 2)	5.578511	3.631724	-6.644541	17.80156
(3 1) vs (0 2)	4.295155	3.949202	-8.996412	17.58672
(3 2) vs (0 2)	1.389651	4.474253	-13.66904	16.44835
(4 1) vs (0 2)	5.338664	4.421879	-9.543759	20.22109
(4 2) vs (0 2)	2.919482	5.473507	-15.50234	21.3413
(5 1) vs (0 2)	6.778022	4.779753	-9.308873	22.86492
(5 2) vs (0 2)	2.673397	4.986637	-14.10979	19.45659
(6 1) vs (0 2)	3.576152	3.683128	-8.819907	15.97221
(6 2) vs (0 2)	3.140908	3.761919	-9.520331	15.80215
(1 2) vs (1 1)	5.252867	1.65589	-.3202502	10.82598
(2 1) vs (1 1)	2.547438	1.144132	-1.303292	6.398168
(2 2) vs (1 1)	5.393941	.9463774	2.208781	8.5791
(3 1) vs (1 1)	4.110585	1.799179	-1.944792	10.16596
(3 2) vs (1 1)	1.20508	2.793285	-8.196094	10.60625
(4 1) vs (1 1)	5.154093	2.682083	-3.872814	14.181
(4 2) vs (1 1)	2.734912	4.23333	-11.51292	16.98275
(5 1) vs (1 1)	6.593451	3.239161	-4.308377	17.49528
(5 2) vs (1 1)	2.488827	3.568361	-9.520969	14.49862
(6 1) vs (1 1)	3.391581	1.098827	-.3066677	7.089831
(6 2) vs (1 1)	2.956338	1.372119	-1.661711	7.574386
(2 1) vs (1 2)	-2.705429	1.689579	-8.391932	2.981075
(2 2) vs (1 2)	.1410734	1.562306	-5.117074	5.399221
(3 1) vs (1 2)	-1.142283	2.187232	-8.503702	6.219137
(3 2) vs (1 2)	-4.047787	3.057194	-14.33718	6.241607
(4 1) vs (1 2)	-.0987741	2.956502	-10.04927	9.851726
(4 2) vs (1 2)	-2.517955	4.411796	-17.36644	12.33053
(5 1) vs (1 2)	1.340584	3.469679	-10.33708	13.01825
(5 2) vs (1 2)	-2.76404	3.778502	-15.48109	9.953013
(6 1) vs (1 2)	-1.861286	1.659157	-7.4454	3.722829
(6 2) vs (1 2)	-2.296529	1.851365	-8.527544	3.934486
(2 2) vs (2 1)	2.846502	1.006417	-.5407282	6.233733
(3 1) vs (2 1)	1.563146	1.83258	-4.604645	7.730937
(3 2) vs (2 1)	-1.342358	2.814069	-10.81348	8.128766
(4 1) vs (2 1)	2.606655	2.704756	-6.496562	11.70987
(4 2) vs (2 1)	.1874736	4.247004	-14.10638	14.48133
(5 1) vs (2 1)	4.046013	3.257701	-6.918214	15.01024
(5 2) vs (2 1)	-.0586115	3.584738	-12.12352	12.0063
(6 1) vs (2 1)	.8441431	1.151283	-3.030655	4.718941
(6 2) vs (2 1)	.4088995	1.414393	-4.351427	5.169226
(3 1) vs (2 2)	-1.283356	1.715484	-7.057046	4.490334
(3 2) vs (2 2)	-4.18886	2.732887	-13.38676	5.009036
(4 1) vs (2 2)	-.2398475	2.626719	-9.080421	8.600726
(4 2) vs (2 2)	-2.659029	4.187945	-16.75411	11.43606
(5 1) vs (2 2)	1.199511	3.193181	-9.547564	11.94659
(5 2) vs (2 2)	-2.905114	3.518099	-14.74574	8.935517
(6 1) vs (2 2)	-2.002359	.9551424	-5.217018	1.2123
(6 2) vs (2 2)	-2.437603	1.250402	-6.645998	1.770793
(3 2) vs (3 1)	-2.905504	3.139614	-13.47229	7.661286
(4 1) vs (3 1)	1.043508	3.035668	-9.173437	11.26045
(4 2) vs (3 1)	-1.375673	4.468454	-16.41485	13.6635
(5 1) vs (3 1)	2.482867	3.539294	-9.429099	14.39483
(5 2) vs (3 1)	-1.621758	3.844093	-14.55956	11.31605
(6 1) vs (3 1)	-.7190032	1.80584	-6.796797	5.35879
(6 2) vs (3 1)	-1.154247	1.982821	-7.827696	5.519203

(4 1) vs (3 2)	3.949013	3.71708	-8.561315	16.45934
(4 2) vs (3 2)	1.529832	4.93385	-15.0757	18.13536
(5 1) vs (3 2)	5.388371	4.135994	-8.531869	19.30861
(5 2) vs (3 2)	1.283746	4.383199	-13.46849	16.03599
(6 1) vs (3 2)	2.186501	2.795681	-7.222737	11.59574
(6 2) vs (3 2)	1.751257	2.905257	-8.026773	11.52929
(4 2) vs (4 1)	-2.419181	4.891207	-18.88119	14.04283
(5 1) vs (4 1)	1.439358	4.059412	-12.22313	15.10185
(5 2) vs (4 1)	-2.665266	4.328158	-17.23226	11.90173
(6 1) vs (4 1)	-1.762512	2.686989	-10.80593	7.280907
(6 2) vs (4 1)	-2.197755	2.808729	-11.65091	7.255395
(5 1) vs (4 2)	3.858539	5.216823	-13.69937	21.41645
(5 2) vs (4 2)	-.2460851	5.400258	-18.42137	17.9292
(6 1) vs (4 2)	.6566694	4.235122	-13.5972	14.91054
(6 2) vs (4 2)	.2214259	4.300396	-14.25213	14.69498
(5 2) vs (5 1)	-4.104625	4.63609	-19.708	11.49875
(6 1) vs (5 1)	-3.20187	3.242513	-14.11498	7.71124
(6 2) vs (5 1)	-3.637114	3.34425	-14.89263	7.618404
(6 1) vs (5 2)	.9027545	3.570696	-11.1149	12.92041
(6 2) vs (5 2)	.467511	3.652587	-11.82576	12.76078
(6 2) vs (6 1)	-.4352436	1.377901	-5.072751	4.202264

Random Sample MANOVA

```
. manova selfperception enjoyment = Boyorgirl Grade Region Ethnicity Boyorgirl#Ethnicity Grade#Region Region#Ethnicity, drope
> mptycells
```

Number of obs = 707

W = Wilks' lambda L = Lawley-Hotelling trace
P = Pillai's trace R = Roy's largest root

Source	Statistic		df	F(df1,	df2) =	F	Prob>F	
Model	W	0.8119	21	42.0	1368.0	3.58	0.0000	e
	P	0.1947		42.0	1370.0	3.52	0.0000	a
	L	0.2236		42.0	1366.0	3.64	0.0000	a
	R	0.1781		21.0	685.0	5.81	0.0000	u
Residual			685					
Boyorgirl	W	0.9984	1	2.0	684.0	0.54	0.5816	e
	P	0.0016		2.0	684.0	0.54	0.5816	e
	L	0.0016		2.0	684.0	0.54	0.5816	e
	R	0.0016		2.0	684.0	0.54	0.5816	e
Grade	W	0.9829	1	2.0	684.0	5.94	0.0028	e
	P	0.0171		2.0	684.0	5.94	0.0028	e
	L	0.0174		2.0	684.0	5.94	0.0028	e
	R	0.0174		2.0	684.0	5.94	0.0028	e
Region	W	0.9983	1	2.0	684.0	0.60	0.5497	e
	P	0.0017		2.0	684.0	0.60	0.5497	e
	L	0.0018		2.0	684.0	0.60	0.5497	e
	R	0.0018		2.0	684.0	0.60	0.5497	e
Ethnicity	W	0.9867	6	12.0	1368.0	0.77	0.6843	e
	P	0.0134		12.0	1370.0	0.77	0.6835	a
	L	0.0135		12.0	1366.0	0.77	0.6851	a
	R	0.0091		6.0	685.0	1.04	0.3988	u
Boyorgirl#Ethnicity	W	0.9611	6	12.0	1368.0	2.28	0.0071	e
	P	0.0393		12.0	1370.0	2.29	0.0071	a
	L	0.0401		12.0	1366.0	2.28	0.0072	a
	R	0.0245		6.0	685.0	2.79	0.0109	u
Grade#Region	W	0.9576	1	2.0	684.0	15.13	0.0000	e
	P	0.0424		2.0	684.0	15.13	0.0000	e
	L	0.0442		2.0	684.0	15.13	0.0000	e
	R	0.0442		2.0	684.0	15.13	0.0000	e
Region#Ethnicity	W	0.9765	5	10.0	1368.0	1.64	0.0911	e
	P	0.0235		10.0	1370.0	1.63	0.0921	a
	L	0.0240		10.0	1366.0	1.64	0.0902	a
	R	0.0214		5.0	685.0	2.93	0.0126	u
Residual			685					
Total			706					

e = exact, a = approximate, u = upper bound on F