A STATISTICAL ANALYSIS OF CHANGES IN ETHNIC IDENTITY AND ETHNIC/RACIAL SELF-CLASSIFICATION

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A Thesis

Submitted to the Graduate College of Bowling Green
State University in partial fulfillment of
the requirements for the degree of

MASTER OF SCIENCE

August 2015

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ABSTRACT

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In this thesis, statistical methods are used to examine developments in ethnic identity and changes in ethnic/racial self-classification at a school district in North Central Ohio. Factor analysis and polychoric correlations are used to create a reliable scale measure of ethnic identity. Parametric and non-parametric analyses of variance and multiple comparison procedures are utilized to examine differences in the strength of ethnic identity among groups of students. In addition, a repeated measures analysis of variance model is utilized to examine developments in ethnic identity over time. Results show discrepancies in the strength of ethnic identity among gender/ethnicity groups in the district but minimal longitudinal changes in ethnic identity. Changes in ethnic/racial self-classification are examined through logistic and ordinal logistic regression, estimations of the proportion of change each semester, and a two-way table analysis. Certain groups of students are found to be highly likely to change ethnic/racial self-classification. In addition, interesting flow patterns between ethnic group classifications are discovered.

ACKNOWLEDGMENTS

I would like to express my gratitude to my advisor, Dr. James Albert, for all of his support and encouragement in my work on this thesis project. Without his help, my completion of this thesis would not have been possible. I would also like to thank the Adolescent Academic Context Study Research Group at Bowling Green State University for allowing me access to the data used in this paper, especially Dr. Margaret Zoller Booth and Dr. Christopher Frey for their outstanding research and crucial questions that fueled the statistical analysis for this paper. Thanks is also extended to my committee members Dr. Nancy Boudreau and Dr. Maria Rizzo for their valuable time and feedback.

I would like to thank the Department of Mathematics and Statistics as well as the Department of Applied Statistics and Operations Research at Bowling Green State University for the invaluable education I have received. Finally, I would like to thank my mom, dad, sister, and friends for their continued support and encouragement.

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CHAPTER 1 INTRODUCTION

1.1 Motivation for Study

The demographics of public schools in the United States have changed significantly in the twenty-first century. According to the National Center for Education Statistics, the number of White students enrolled in pre-kindergarten through twelfth grade decreased from 28.7 million to 25.6 million (60% to 52% of total share in enrollment) from 2001 to 2011 with other races making up a larger share of enrollment in public schools [31]. The NCES noted that Hispanic students had the largest increase in enrollment among all ethnic groups; their percentage share in total enrollment increased by seven percent (from 17% to 24%) in the same ten year period. The racial makeup of schools changed for all regions of the country with the largest increase in non-White student population occurring in Western states [31].

As demographic changes continue to occur in schools throughout the country, teachers and school administrators need to be prepared to handle more diverse classrooms. While students who were not classified as White made up nearly 50% of public school enrollment in 2011 [31], the National Center for Education Information estimates that for that same year, the vast majority (84%) of the teaching population was White [14]. The growing difference in the racial makeup of teachers and students has been shown in some studies to pose problems for the school learning environment. For example, results from a survey administered to a sample of 1000 teachers from 48 states reported that only 36% of teachers listed having had "quite a bit/great deal" of training in assigning students to work in diverse groups and only 39% of teachers listed having had "quite a bit/great deal" of training in the different learning styles of different racial and ethnic groups [15]. Teachers who are not from an ethnic minority may not be as sensitive to the needs of students from ethnic minority groups.

As part of this teacher/student divide, when ethnic minority adolescents experience a period of identity development [13] [29], an element of this growth involves an understanding of ethnic

identity [34]. However, teachers and administrators who are White in a predominately White community may have never struggled with their own racial/ethnic self-identification and may lack an understanding of racial/ethnic development among minority adolescents. As a result, the motivation of this study is to provide additional insight into how adolescent students develop in their ethnic identity and vary their ethnic/racial self-classification. The following five questions motivate the study:

- Does the strength of ethnic identity differ among groups of adolescent students in a multicultural school environment?
- Does the strength of ethnic identity change over time for adolescents and is it stronger for a particular ethnic/racial group?
- Do youth change their ethnic/racial classification during their adolescent school years?
- When adolescent students change their ethnic/racial classification, are some groups of adolescent students more likely to do so?
- Are there any attitudinal or socio-emotional predictors of changing ethnic/racial self-classification?

To answer these questions, a statistical analysis of changes in student responses of ethnic identity and ethnic/racial self-classification is carried out using data from a school district in North Central Ohio. Before presenting the results of the statistical analysis, a description of ethnic identity and ethnic/racial self-classification is provided alongside a literature review of previous research on both topics. In addition, the setting of the study is described with a clear outline of the statistical methodology used in the analysis.

1.2 Ethnic Identity

1.2.1 Models of Identity Formation

Models of ethnic identity primarily have stemmed from ego identity formation theory from developmental psychologists Erik Erikson and James Marcia. In 1968, Erikson postulated that

individuals pass through eight stages of development throughout the lifespan. The fifth stage, identity, is the stage that Erikson describes as a time of psychosocial development when adolescents encounter and resolve conflicts that lead the formation of identity and a self-understanding of how they fit in society [13]. Erikson refers to these conflicts as an identity crises. Through these identity crises, adolescents begin to make important choices about future careers, political values, and religious ideology [42].

In 1980, Marcia built on Erikson's theory by breaking the identity stage into sub-statuses. Marcia suggested four statuses of identity formation: foreclosure, diffusion, moratorium, and identity achievement [29]. Individuals fall in one of four statuses depending on the extent of exploration and commitment to developing his or her identity. Excerpts from Shaffer's *Developmental Psychology Childhood and Adolescence* provide a valuable description of the four statuses [42]. Shaffer describes that individuals are classified as foreclosed if they have committed themselves to an ideology (religion, moral value, et cetera) but have never questioned their commitment to the ideology. The diffusion status refers to individuals who have neither questioned nor committed themselves to a particular ideology or value [42]. According to Shaffer, individuals who fall into the moratorium status have experienced what Erikson described as an identity crisis; they have actively searched for information but have not fully committed themselves to an ideology. Finally, identity achievement characterizes individuals who have resolved identity issues and have made firm, clear commitments regarding life goals, values, and beliefs [42].

1.2.2 Phinney's Model of Ethnic Identity Formation

An important part of identity formation for minority adolescents is the development of ethnic identity. One of the most well-known and referenced models is that of developmental psychologist Dr. Jean Phinney which includes three primary stages: unexamined ethnic identity, ethnic identity search, and achieved ethnic identity [34]. Phinney clearly defines the three stages in a 1990 publication. In the unexamined ethnic identity stage, the adolescent has not experienced issues pertaining to ethnic identity and has not questioned the role of ethnicity in life [35]. Phinney suggests two possible subgroups of the unexamined ethnic identity: diffusion and foreclosure. Regarding

diffusion, the adolescent may not have given much thought to the issue of race or ethnicity which differs from foreclosure in which the adolescent forms opinions about ethnicity primarily based on the views of parents or peer adolescents [35]. Phinney characterizes the ethnic identity search phase as a period in which the adolescent has experienced an event that forces an awareness of belonging to an ethnic group and probes the child to search for more information and participate in certain activities to discover his or her ethnic identity. The final stage of the ethnic identity development process, achieved ethnic identity, involves the adolescent internalizing his or her ethnicity and coming to a level of satisfaction and understanding of his or her ethnicity [35].

While Phinney's model provides the most common framework for how many approach the study of ethnic identity, the definition of ethnic identity varies from researcher to researcher. Ting-Toomey defines ethnic identity in terms of commitment and belonging (p. 383): "It is the depth of commitment to certain shared patterns of communication, underlying beliefs, and philosophy of life with a particular cultural group" [43]. A definition provided by White and Burke in 1987 reflects that ethnic identity is associated with communal attitudes and values (p. 311): "Ethnic identity reflects understanding shared by members of the ethnic groups, of what it means to be Black, White, Chicano, Irish, Jewish, and so on" [48]. The variance of the definition of ethnic identity suggests that it is still for the most part largely misunderstood. In 1990, Phinney described it best (p. 500): "The fact that there is no widely agreed-on definition of ethnic identity is indicative of confusion about the topic" [35].

1.2.3 Ethnic Identity and Acculturation

Ethnic identity often is discussed hand and hand with acculturation. Acculturation refers to change that results from two or more distinct cultures interacting over time [35]. The interaction of different cultures forces an awareness of the place of one's culture as a sub-component of a larger community. In 1990, Phinney described that acculturation is essential for ethnic identity development and makes the study of ethnic identity meaningful (p. 501): "Ethnic identity is meaningful only in situations in which two or more ethnic groups are in contact over a period of time. In an ethnically or racially homogeneous society, ethnic identity is a virtually meaningless concept"

[35]. Without an ethnically heterogeneous environment, the adolescent does not have exposure to certain racial/ethnic issues which hampers the development of ethnic identity.

1.2.4 Literature Review

Literature suggests that ethnic identity development is strengthened when the adolescent experiences exposure to people of different backgrounds and cultures but is weakened when the adolescent's ethnic group is the majority. In a 2014 publication, Umaña-Taylor and several researchers reference studies in which Latino/a adolescents show increased ethnic identity formation when attending schools made up of predominately White students but show less strong changes in ethnic identity when in the presence of a dominant Latino/a population [45]. Phinney found that White adolescents were less likely to be exposed to conflicts in their identity development when White adolescents represented the majority culture [34]. Such research further connects the relationship between ethnic identity and acculturation.

Previous research suggests that ethnic identity development differs for males and females. Women may have stronger ties to their ethnicity than males because there may be the assumption that women are more responsible than men to pass on ethnic traditions to future generations [35]. In a 1990 literature review, Phinney cites two studies that provide evidence of the previous suggestion. In 1981, Ting-Toomey examined a group of Chinese American College students and found that women were more likely than men to have stronger knowledge of their ancestral culture [43] [35]. Another study by Bolling in 1974 showed stronger scores on a black identity test for females compared to males in both Black and Black Puerto Rican ethnic groups [7] [35]. Literature also shows that ethnic identity development may occur for different reasons between the genders for African American adolescents. As referenced by Chae in 2002, the results of a study by Bowman and Howard in 1985 showed that African American females were more likely to develop strong connections to their ethnic group in relation to ethnic practices and traditions compared to African American males who were more likely to develop in an awareness of ethnic tension and search for equality [10] [8].

Literature provides evidence that ethnic identity formation is associated with positive outcomes

in the school learning environment for adolescents of ethnic minority groups. Two 2014 studies by Booth and several researchers found that stronger feelings of ethnic identity were linked to positive feelings about school [5] and the belief that one could succeed academically [4]. A literature review by Rivas-Drake and other researchers note a number of studies in which ethnic identity formation was associated with a decreased risk in adolescents participating in risky behaviors such as drug and alcohol use [39]. In addition, the literature review also highlighted studies in which stronger feelings of ethnic identity were found to be a moderator of perceptions of racial discrimination and problem behavior with African American students [39].

Since ethnic identity is a developmental concept, it is surprising that there has been a lack of longitudinal research on ethnic identity. In 2000, French and other researchers examined a cohort of 144 adolescents from the transition from middle school to high school and found changes in ethnic identity for African American and European Americans [16]. The results of the study were also summarized by French and others in a 2006 publication; factors such as the racial/ethnic make up of students and teachers as well as changes in school environment were found to mediate the change [16] [17]. A few newer studies showed mixed results in longitudinal patterns in ethnic identity. A study by Huang and Stormshak in 2011 found six different ethnic identity trajectories among adolescents using latent growth models [21]. A recent research article by Johnson and Lambie in 2013 followed a group of 94 multicultural students over two time points and no statistically significant change in their ethnic identity was found over time [24].

1.3 Ethnic/Racial Self-Identification

1.3.1 Self-Identification and Possible Misconceptions

Ethnic/racial self-identification is the ethnic group label that an individual assigns to oneself [35]. Self-identification is a more narrow concept than ethnic identity in that it is associated purely with classifying oneself into a single ethnic group such as Native American, Asian, African American, Hispanic, White, or Multiracial. While this seems like a simple concept, ethnic/racial self-identification might be just as misunderstood as the definition of ethnic identity.

A 1996 study conducted by the U.S. Department of Education reported that nearly 75% of school districts in the United States used the standard five racial categories (Hispanic, American Indian/Alaska Native, Asian/Pacific Islander, Black, and White) to collect data on the race of students which did not have a Multiracial option nor allowed the selection of multiple races [47]. The 1996 study also reported that 22% of districts relied on teachers and administrators to estimate the racial makeup of schools by observation [47]. It was not until 2007 that the United States Department of Education standardized procedures for collecting and reporting data on race and ethnicity [46]. The fact that these changes were made so recently suggests that there may still be misunderstandings of ethnic/racial self-classification, especially in the educational setting. This motivates further research of ethnic/racial self-identification among adolescents.

1.3.2 Relationship With Ethnic Identity

While ethnic/racial self-identification has been described as a more restricted concept than ethnic identity, self-identification has been listed by many scholars as a key component of ethnic identity formation [35]. In the ethnic identity development process, adolescents work to achieve a sense of belonging and attachment to an ethnic group. Thus, a crucial part of that achievement must involve selecting an ethnic group of membership.

Researchers suggest that the significance of self-identification as a part of ethnic identity development is not constant across adolescents of all ethnic minorities. Self-identification may play the largest role in ethnic identity development for Multiracial adolescents because racial self-categorization is less straightforward. Hitlin, Brown, and Elder describe the potential role of self-identification on identity formation for Multiracial adolescents in the following way (p. 1299): "The act of self-categorization may conjure a self-categorization that a larger society seems to demand. Or, it may represent a chance to celebrate or affirm that one's heritage is tied to two or more racial categories" [20]. Selecting a racial/ethnic category is a more complicated task for Multiracial adolescents and, if achieved, can have a profound, significant effect on ethnic identity formation.

1.3.3 Literature Review

Research suggests that racial categorization among adolescents depends largely on context. In 2002, Harris and Sim found that estimates of Multiracial classification differ significantly depending on whether the adolescent was given a survey at home or at school. While 8.6% of adolescents in the study reported their classification as Multiracial at home or at school, only 1.6% agreed in both locations [18]. A 2013 study by Burke and Kao found that self-reports of ethnicity at home for adolescents largely matched their mother's ethnicity [9]. The fact that ethnic/racial self-identification differs by context such as the location and the presence of a parental figure poses implications for the study of ethnic/racial self-identification.

Literature provides evidence that phenotype or physical appearance largely affects ethnic/racial classification; physical appearance can limit the number of choices, and the choice can be impacted by the perceptions of others. For example, a 2004 study by Herman found that Black Multiracial adolescents overwhelmingly chose to self-identify as Black when forced to chose a single race category; among 160 students who self-identified as Black-White when allowed to choose multiple-race categories, 68% self-reported as Black when forced to select one race [19]. When forced to choose a single-race category, Multiracial individuals could choose to identify with the minority group out of fear of perceived discrimination from the majority culture [19] [20].

Research shows that characteristics such as gender and age impact ethnic/racial self-identification. In a 2003 publication, Lopez found that women and girls were more likely to identify with more than one ethnic group. Fifty-six percent of the females in the study chose two or more classifications for themselves compared to only forty-nine percent of males (however, not statistically significant) [28]. Scholars suggest that self-identification differences between males and females are attributed to females being more sensitive to negative comments about race and ethnicity [12]. Theories of the impact of age on ethnic/racial categorization suggest that younger adolescents show more variation in classification than older adolescents. Using Erikson's theory, scholars suggest that after a certain period of identity search, adolescents are expected to eventually arrive at a more stable understanding of their race [13] [36] [20] [9].

Longitudinal research on consistencies in ethnic/racial self-classification has been limited. A comparison of Census data from 2000 to 2010 showed that non-Hispanic Whites, African Americans, and Asians were generally stable in reporting the same ethnic/racial self-classification compared to Native American, Pacific Islander, and multiple-race groups that were particularly unstable in reporting the same classification [27]. Two studies using data from the National Longitudinal Study of Adolescent Health provide additional information on what ethnic groups show instability in classification and also possible reasons for the change. Doyle and Kao in 2007 found that Multiracial adolescents were the most likely to change classification with Native American adolescents displaying the highest likelihood of changing ethnic classification among single race ethnic groups [12]. Hitlin, Brown, and Elder in 2006 discovered that adolescents who had mothers with a higher level of education, higher ratings of self-esteem, and who lived in a predominately White neighborhood were less likely to change ethnic/racial classification [20].

1.4 Setting for Study

1.4.1 Adolescent Academic Context Study

This study is a part of a larger ongoing study at Bowling Green State University called the Adolescent Academic Context Study (AACS). A group of researchers at BGSU has collected both quantitative and qualitative data from students, parents, and teachers from a district located in North Central Ohio. The school district's name is not reported for confidentiality reasons. The AACS research group received approval from the BGSU Human Subjects Review Board (approval number: H09P301FFB) to collect four school years or eight semesters of data from fall 2009 to spring 2013. The initial sample of students was selected through a passive consent form process, yielding a response rate of 89% for middle school students (grades 7 and 8) and 74% for high school students (grades 9 and 10) [6]. The data are being used to examine relationships between school climate, student perceptions of learning environment, academic achievement, et cetera. Data collected on students include student survey responses, academic achievement data from the state of Ohio, and responses from in-person interviews. The data have produced a number of

publications, including two on the study of ethnic identity.

In a 2014 publication, AACS researchers Margaret Zoller Booth, Sara Abercrombie, and Christopher Frey examined the association between ethnic identity, academic self-efficacy, and academic achievement [4]. Using the fall 2010 and spring 2011 district data, the researchers found differences in ratings of ethnic identity among students of different ethnic groups in the district. Ethnic identity ratings alongside a mathematics achievement score for the Ohio state exam were found to significantly predict academic self-efficacy of students in the district [4]. In particular, ethnic identity was found to have a positive association with academic self-efficacy; stronger ethnic identity fostered positive feelings about the ability to succeed academically.

Another AACS 2014 publication by Booth and Frey with Erin Curran, Jean Gerard, Bruce Collet, and Jennifer Bartimole, examined the relationship between ethnic identity, attitude toward school, and perceptions of school environment [5]. The fall 2010 survey data were utilized in the study, and the researchers found a statistically significant difference in ethnic identity ratings among students of different ethnic groups in the analysis. African American and Hispanic students were found to display stronger feelings of ethnic identity than White and Multiracial students in the district. Significant differences in ethnic identity were found among ethnic groups for each gender. African American males had stronger feelings of ethnic identity compared to White males in the district. Both Hispanic and African American females expressed stronger ethnic identity compared to their Multiracial and White female peers. Positive associations were found between ethnic identity and perceptions of school climate and attitude toward school.

These AACS publications provide insight into ethnic identity development in adolescence and its connection to academic achievement and feelings about school. This study used AACS student survey response data to extend the examination of ethnic identity longitudinally and provide insight into changes in ethnic/racial self-classification. The AACS publications are referenced when appropriate in the statistical analysis and conclusion.

1.4.2 School District Demographics

The demographics of the school district of study motivate the use of the AACS data to study ethnic identity and ethnic/racial classification. In the 2009-2010 school year, the first school year of data collection for the AACS study, there were 4,213 total students enrolled in the district of study. The gender distribution was 48.8% female and 51.2% male. The ethnicity breakdown of enrollment was the following: 64% White, 12.8% Multiracial, 15.1% Hispanic, 7.5% Black, and 1% other races [32]. The district falls in the Ohio Department of Education's typology 1, meaning that the district displays above average poverty ratings, low median income, and a low percentage of adults with a college degree [33]. Related to this, 57.8% of students in the district were flagged as economically disadvantaged. In addition, 6.9% were English language learners and 1% were migrant students in the 2009-2010 school year [32]. The gender and ethnicity breakdown for teachers in the district differed greatly from that of the students. Over seventy percent of teachers in the district in the 2009-2010 school year were female (76.5%), and an overwhelming majority of the teachers were White (96.2%) [32].

While the majority of students were White in the district, the percentage of White students of the total was much lower than the state percentage (64% district versus 75.2% state) and more close to national percentages [32]. The ethnic differences motivate the study of ethnic identity and ethnic/racial self-classification in the district. In addition, the differences in the racial/ethnic make-up between students and teachers provides a unique setting for the study.

1.5 Data Description and Statistical Methods

The statistical analysis for the study was broken into two parts: one for ethnic identity and one for ethnic/racial self-classification.

1.5.1 Ethnic Identity Analysis

The goal of the ethnic identity analysis was to answer the two questions that were posed in the motivation of the study related to ethnic identity:

- Does the strength of ethnic identity differ among groups of adolescent students in a multi-

cultural school environment?

- Does the strength of ethnic identity change over time for adolescents and is it stronger for particular ethnic/racial group?

Data Description

To answer the questions pertaining to ethnic identity, student responses from the ethnic identity section of the AACS survey were examined. The ethnic identity section was not implemented as part of the AACS survey until the second year of data collection (2010-2011 academic year). Fall 2010 data were utilized to examine how ethnic identity differed among groups of students in the district. Self-reported gender and ethnicity in fall 2010 were utilized to separate students into groups for statistical analysis. Data for approximately 900 students in the district were utilized in the fall 2010 analysis.

To examine ethnic identity longitudinally, data from the ethnic identity section from fall 2010 to spring 2012 were utilized (four semesters). Eventhough, the ethnic identity section of the survey was provided in the final year of data collection (2012-2013 academic year), data from this year were not used because a class of students graduated the previous May; it would have resulted in a much smaller sample size. Roughly 340 students in the district were examined longitudinally because they had survey data for all four semesters. The self-reported ethnicity in fall 2010 was used to separate the students in the analysis into groups for longitudinal analysis.

Statistical Methods

To create a reliable measure of ethnic identity, a polychoric correlation matrix was examined and a factor analysis was conducted on the fall 2010 ethnic identity survey items. Once a reliable scale was created, differences in the mean ethnic identity scale among gender and ethnicity groups were investigated using a two-way analysis of variance model. Both parametric and non-parametric ANOVA procedures were utilized because the scale was not normally distributed. Multiple comparisons using Bonferroni adjusted correction were utilized to identify statistically significant dif-

ferences in the mean ethnic identity scale among gender/ethnicity groups in the district.

To see if there was a significant change in ethnic identity over time for the students in the analysis and whether the change was stronger for a particular ethnic group, a repeated measures analysis of variance with a between subjects factor of ethnicity, a within subjects factor of time, and an interaction of the two factors was carried out. Finally, the within subjects variation of the ethnic identity scale score over time was examined through an exploratory analysis on the standard deviation of the score over the four semesters.

1.5.2 Ethnic/Racial Self-Classification Analysis

The goal of the ethnic/racial self-classification was to answer the three questions that were posed in the motivation of the study related to ethnic/racial self-classification:

- Do youth change their ethnic/racial classification during their adolescent school years?
- When adolescent students change their ethnic/racial classification, are some groups of adolescent students more likely to do so?
- Are there any attitudinal or socio-emotional predictors of changing ethnic/racial self-classification?

Data Description

To examine changes in ethnic/racial self-classification of students in the district, self-reports of ethnicity were used from the fall 2009 to spring 2012 AACS surveys. A variable was created to count the number of changes in ethnic/racial self-classification for each student. This variable was collapsed into a binary variable for no changes versus one or more changes as a dependent variable for a logistic regression analysis. Another variable was created by collapsing the number of changes variable into three categories: no change, one change, or 2 or more changes as a dependent variable for an ordinal logistic regression analysis. Demographic variables collected from the fall 2009 survey such as self-reported gender, ethnicity, and grade level were used to separate students into groups for analysis. In addition, four survey scales taken from the fall 2009 AACS survey

measuring self-esteem, hope, attitude toward school, and perceptions of school environment were considered as independent variables in both the logistic and ordinal logistic regression models.

Statistical Methods

To provide insight into which students were changing ethnic/racial self-classification a modeling approach was utilized. To model the binary outcome of no changes versus one or more changes in ethnic/racial self-classification, a logistic regression model was implemented. Because a number of students changed classification more than one time, an ordinal logistic regression model was also fit to the data to model the outcome of 0 changes, 1 change, or 2 or more changes in ethnic/ racial self-classification. Demographic variables of gender, ethnicity, and grade level were used to identify which groups of adolescent students were most likely to change ethnic/racial self-classification. The four survey scales of self-esteem, hope, attitude toward school, and perceptions of school environment were considered as possible socio-emotional predictors of changing ethnic/racial self-classification.

To provide additional insight into the context for why students were changing classification, estimates of the proportion of change were calculated for each semester of data collection, and these were broken out by the gender and ethnicity the student reported in fall 2009. In addition, a two-way table analysis of the student's beginning self-classification compared to the ending self-classification was used to identity any interesting "traffic patterns" in changing classification between ethnic groups.

CHAPTER 2 ETHNIC IDENTITY ANALYSIS

2.1 Ethnic Identity Scale Calculation for Study

In 1992, Dr. Jean Phinney, a developmental psychologist, proposed a measure of ethnic identity called the Multigroup Ethnic Identity Measure (MEIM). The MEIM scale originally included twenty items; however Phinney focused her research on fourteen of those twenty items [36]. The ethnic identity section of the AACS survey was comprised of these fourteen survey questions, and a list of these items is provided in Appendix A. The MEIM scale is typically computed by rolling up student responses to all items into a single measure of ethnic identity. An individual rates himself or herself using the four-level Likert Scale (1-Strongly Disagree, 2-Disagree, 3-Agree, 4-Strongly Agree) for each question. Before combining all of the items into a single scale, negatively phrased items six and seven are reverse coded (1=4, 2=3, 3=2, and 4=1). It is imperative to reverse code the negative items so that all numerical values assigned to the items have consistency in their meaning. The MEIM scale, which is typically computed as an average of the items after reverse coding, ranges from 1 to 4 with 1 corresponding to low ethnic identity and 4 corresponding to high ethnic identity.

Since its creation by Phinney in 1992, the MEIM scale has been utilized in many research articles to quantify ethnic identity. The calculation of the scale as well as which items are included in the scale often vary. To determine how the scale was to be computed for this study, a correlation matrix of the 14 survey items was examined and a factor analysis was conducted. The motivation for examining the correlation and factorial structure of the MEIM items was to ensure that a scale comprised of all items provided a consistent, reliable measure of ethnic identity for the students in the study. If some items were found to detract from the scale rather than strengthen the scale, they were removed from the scale calculation. Survey data from the fall 2010, the first semester that the ethnic identity section was included in the AACS survey, were utilized for the scale calculation analysis. Among the 984 students at the district who completed the AACS survey in fall 2010,

only 858 students answered all 14 ethnic identity items and were included in this analysis.

2.1.1 Correlation Structure of Ethnic Identity Survey Items

Pearson versus Polychoric Correlations

Pearson correlation is the most well-known correlation coefficient and is computed with the assumption that the variables of interest are continuous (height, weight, student's SAT score, et cetera). The ethnic identity survey items were categorical, ordinal variables. In other words, a student could choose from one of four possible ratings, and there was a natural ordering of the ratings: strongly disagree $<$ disagree $<$ agree $<$ strongly agree. Research has shown that the Pearson correlation coefficient often underestimates the true correlation of ordinal variables [22]. For this study, it was assumed that the distance between two categories, say strongly disagree and disagree, was one. In reality, the thresholds separating categories could be more or less and could vary as one moves from one side of the scale to the other. Ignoring such information could result in poor correlation estimates.

A better correlation coefficient to use with ordinal data is the polychoric correlation. It estimates what the true correlation between two ordinal items would be if they were continuous and assumes no specific width separating the categories. Computer programs use an iterative method to vary category thresholds until observed classification proportions are as close to the expected proportions as possible and then compute the correlation [44]. The value of a polychoric correlation has the same meaning as Pearson correlation: (< 0 negative relationship, 0 little to no relationship, and > 0 positive relationship). As the correlation approaches 1 in absolute value, the relationship between the two variables is strong. As the correlation approaches 0, the relationship is weak.

Polychoric Correlation Matrix

Pairwise polychoric correlations of the 14 survey items are given in Table 2.1. The reverse coded, negatively phrased items (items 6R and 7R) had low and sometimes negative correlations with the other items in the section. In addition, these two items were highly correlated with each other,

Item	1	2	3	4	5	6R	7R	8	9	10	11	12	13	14
1	1	.54	.59	.55	.31	.10	.41	.41	.42	.58	.42	.55	.56	.43
2	-	1	.43	.47	.31	-.07	.19	.36	.31	.41	.33	.51	.41	.37
3	-	-	1	.53	.49	.31	.29	.56	.68	.46	.59	.54	.61	.51
4	-	-	-	1	.28	.06	.21	.47	.47	.49	.40	.49	.52	.31
5	-	-	-	-	1	.12	.04	.51	.53	.25	.60	.34	.48	.56
6R	-	-	-	-	-	1	.45	.14	.28	-.01	.18	.08	.24	.15
7R	-	-	-	-	-	-	1	.10	.13	.26	.12	.24	.20	.15
8	-	-	-	-	-	-	-	1	.67	.42	.63	.45	.64	.52
9	-	-	-	-	-	-	-	-	1	.47	.65	.51	.65	.53
10	-	-	-	-	-	-	-	-	-	1	.40	.57	.49	.36
11	-	-	-	-	-	-	-	-	-	-	1	.58	.70	.75
12	-	-	-	-	-	-	-	-	-	-	-	1	.62	.56
13	-	-	-	-	-	-	-	-	-	-	-	-	1	.70
14	-	-	-	-	-	-	-	-	-	-	-	-	-	1

Table 2.1: Pairwise Polychoric Correlations of 14 Survey Items

indicating that students answered these questions uniquely. With the exception of items 6R and 7R, the remaining items all had positive correlations with each other indicating students generally rated themselves on the same side of the scale for these questions. Pairwise correlations that were very high ($r > 0.70$) are circled in the table. Students answered these questions similarly. These questions related to how much pride or attachment a student felt toward his or her ethnic group. Cronbach's alpha, a measure of overall correlation and reliability, was 0.88 for the 14 items. Generally, a Cronbach's alpha coefficient of 0.70 or higher signifies a strong relationship among a group of variables [38].

2.1.2 Factor Analysis of Ethnic Identity Survey Items

Factor analysis represents the observed variables as linear combinations of a fewer set of random variables called factors. The factors are underlying, latent variables that are often difficult, if not impossible to measure, such as ethnic identity. If correlations among the observed variables are reasonably high, the information contained in the observed variables can be represented in a smaller set of linear combinations of factors [11]. Here, it was hoped that a small set of linear combinations of the 14 ethnic identity items could be extracted to measure a student's overall feelings

of ethnic identity. It is important to note that factor analysis extracts reliable information if the variables are continuous and come from a multivariate normal distribution [3]. Since the polychoric correlations extract information as if the survey items are continuous, a polychoric correlation matrix was used instead of a Pearson correlation matrix to best deal with these assumptions. The rotated factor pattern obtained using a Varimax rotation is provided in Table 2.2 (R suppressed the output of small loadings, and these loadings are denoted with dashes in the table). A three factor solution was discovered. A scree plot and an eigenvalue summary is provided in Appendix B as Figure 1 and Table 1, respectively.

Given the patterns that were found in the polychoric correlation matrix, it was no surprise that the two reverse coded, negatively phrased items fell on a single factor (factor 3). This indicated that students answered these two questions uniquely compared to the other items in the section. A publication in 1999 by Phinney and other researchers obtained a similar result, and it was determined that the two questions might have been difficult for students to understand [41]. A side analysis, provided in Appendix B (pages 75-77), showed that a good number of students answered all items on the extreme (all 1's or 4's) for the entire section missing the negative phrasing of items 6 and 7. This caused weak and sometimes negative correlation estimates of 6R and 7R with the other 12 items in the section after reverse coding. The students who rated themselves on the extreme for all items really meant for their ethnic identity scale score to be a 1 or a 4; however, the reverse coding adjusted their scale away from what they intended it to be. To ensure that the ethnic identity scale measured the student's true feelings of ethnic identity, it was recommended to remove items 6 and 7 from the scale calculation.

Items 6 and 7 were removed and a subsequent factor analysis was conducted on the remaining 12 items with a newly estimated polychoric correlation matrix and a Varimax rotation. A two factor solution was obtained (see Figure 2 and Table 2 in Appendix B for an eigenvalue summary and scree plot). The rotated factor pattern is given in Table 2.3. Items 5, 8, 9, 11, 13, and 14 loaded the highest on the first factor compared to items 1, 2, 4, 10, and 12 that loaded highest on the second factor. The loadings on item 3 were nearly the same on both factors, providing ambiguity

Item/Factor	1	2	3
1	0.258	0.780	0.151
2	0.248	0.599	-
3	0.562	0.490	0.273
4	0.324	0.606	-
5	0.678	0.139	-
6R	0.200	-0.132	0.968
7R	-	0.367	0.531
8	0.673	0.324	-
9	0.681	0.330	0.186
10	0.278	0.660	-
11	0.847	0.250	-
12	0.490	0.574	-
13	0.717	0.437	0.156
14	0.758	0.269	-

Table 2.2: Rotated Factor Pattern of 14 Survey Items

on which factor item 3 should fall. Item 3 relates to a feeling or attachment or belonging to one's ethnic group and would be more suitable paired with the items that fell on factor 1 for interpretation purposes. Since Cronbach's alpha was very high for the 12 items as a group (α = .90) and the two sub-measures of ethnic identity had difficult interpretation, it was suggested to use the 12 item scale in the study.

2.1.3 Scale Calculation

Items 6 and 7 were removed from the scale calculation. Removing these questions ensured that the scale best represented a student's feelings of ethnic identity. In addition, the scale had a higher reliability when removing the items (Cronbach's alpha increased from 0.88 to 0.90 after removing 6R and 7R); the reliability of the scale was essential for this study as changes in the scale were examined over time. While the average was the most commonly used function for the MEIM in other studies, a sum of the 12 items represented the scale for this study. The reason for this choice was that changes in the scale were examined over time, and it was much easier to communicate a change in a sum compared to a change in an average. The score was computed for a student if he or she answered at least 75% or nine of the 12 items in the section. To protect against the

Item/Factor	1	2
1	0.253	0.756
2	0.215	0.598
3	0.538	0.555
4	0.273	0.658
5	0.669	0.164
8	0.637	0.381
9	0.638	0.422
10	0.242	0.671
11	0.850	0.277
12	0.465	0.596
13	0.693	0.496
14	0.770	0.273

Table 2.3: Rotated Factor Pattern of 12 Survey Items

sum underestimating a student's feelings of ethnic identity if items were skipped, the scale was computed by multiplying the student's average scale score by twelve. This converted the student's sum scale score to what it would have been if he or she had answered all of the items.

2.2 Fall 2010 Ethnic Identity Scale Findings

Once a reliable scale of ethnic identity was established, the next step was to investigate how the scale differed for certain groups of students in the district. Research by Booth, Curran, Frey, Gerard, Collet, and Bartimole (2014) using the fall 2010 district data suggested that African American and Hispanic students typically had higher ratings of ethnic identity compared to White and Multiracial students. In addition, interesting findings were found for specific gender and ethnicity interactions [5]. The researchers used the 14 item scale instead of the 12 item scale in their study.

Since this analysis was a prelude to a longitudinal study on the scale, it was important to ensure that the scale did not differ by age (grade level). A preliminary analysis showed that the scale did not differ by grade level nor the interaction of grade level and other characteristics of students such as gender and ethnicity. This suggested that all students began the study at level footing as far as age affecting the scale. For simplification purposes, the fall 2010 scale findings based on gender and ethnicity were only presented.

2.2.1 Study Participants

Roughly 940 students (937 total students) were initially considered for the fall 2010 analysis as they answered at least 75% of the items the ethnic identity section that semester. Eight students were removed from the study because they did not report their gender and/or ethnicity. In addition, six students self-identified as Native American, and seven students self-identified as Asian/Pacific Islander. These sample sizes were too small for meaningful statistical analysis, and these students were excluded. This resulted in a final sample size of 916 students. A breakdown of the sample size by gender and ethnicity is provided in Table 2.4.

Gender/Ethnicity	White	Multiracial	Hispanic	African American	Total
Male	264	85	54	38	441
Female	291	104	56	24	475
Total	555	189	110	62	916

Table 2.4: Sample Sizes by Gender and Ethnicity

2.2.2 Exploratory Data Analysis

Parallel box plots of the scale score broken out by gender and ethnicity separately are given in Figure 2.1. The scale score did not appear to differ among the sexes; however, the scale score did appear to differ among the ethnic groups. African American and Hispanic students typically rated themselves the highest regarding ethnic identity while White students had the lowest ratings of ethnic identity. The spread of the scale score also appeared to differ among the ethnic groups. The spread of the scale score for African American students was lower than that of the other ethnic groups, indicating that African American students showed more consistency in their self-ratings as a group. Ratings of ethnic identity appeared to differ by both gender and ethnicity. The median scale score is plotted by gender and ethnicity in Figure 2.2. The median scale score differed greatly between the sexes for African American students.

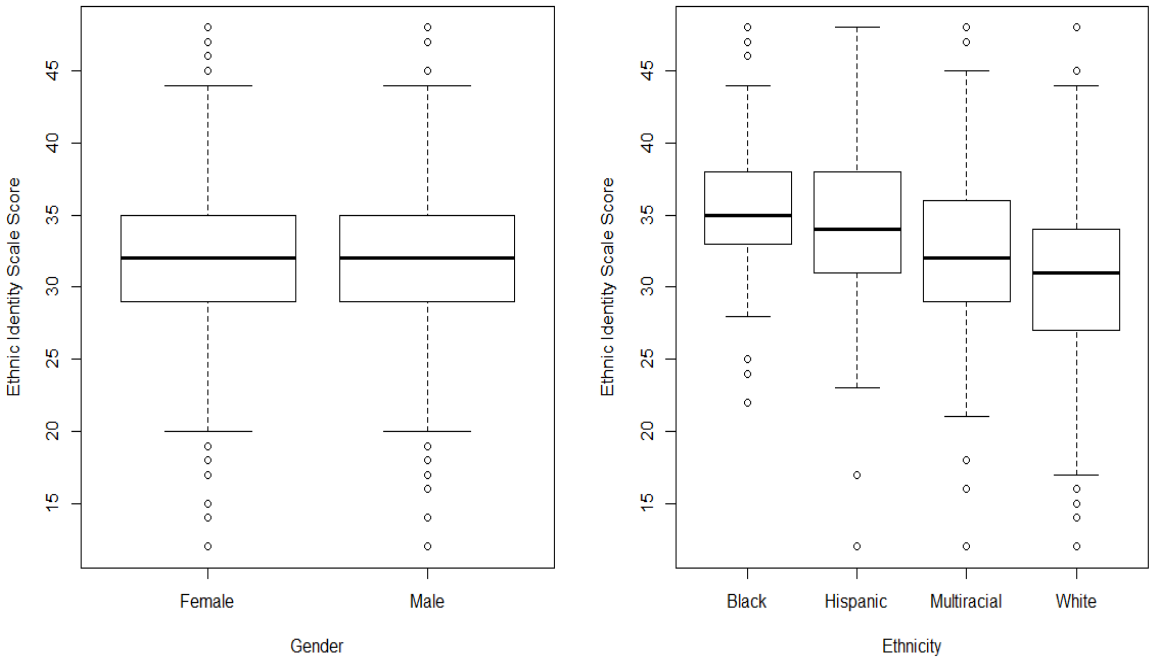

Figure 2.1: Parallel Box Plots of Scale Score by Gender and Ethnicity

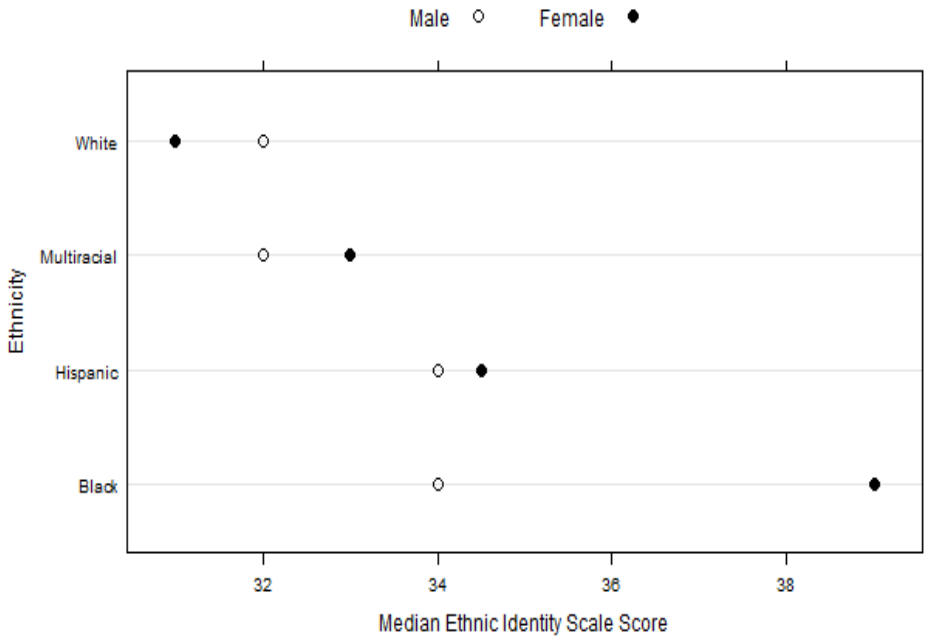

Figure 2.2: Plot of Median Scale Score by Gender and Ethnicity

2.2.3 Analysis of Variance

The results of the exploratory data analysis suggested that non-White students typically had higher ratings of ethnic identity with African American and Hispanic groups having the highest ratings among all ethnic groups. These results were consistent with the results found by Booth and her fellow researchers [5]. While ethnic identity ratings did not differ much by gender alone, it did appear to differ by gender and ethnicity. The greatest difference between the sexes appeared for African American students. To investigate other statistically significant differences, a two-way analysis of variance procedure was conducted with gender, ethnicity, and the interaction of gender and ethnicity as factors using the following model:

$$Y_{ijk} = \mu + \alpha_i + \beta_j + \alpha\beta_{ij} + \epsilon_{ijk},$$

where $i = 1, 2$ and $j = 1, 2, 3, 4$ and $k = 1, 2, 3, \ldots, n_{ij}$. The parameter μ represented the overall mean ethnic identity scale score. The parameter α_i represented the ith adjustment to the overall mean for the ith level of gender, and the parameter β_j represented the jth adjustment to the overall mean for the jth level of ethnicity. Finally, the parameter $\alpha\beta_{ij}$ represented the $ijth$ adjustment to the overall mean for both the ith level of gender and jth level of ethnicity.

As anticipated from the exploratory analysis results, gender and ethnicity interacted to affect the scale score significantly (F = 4.32, p-value = 0.0049). Since the interaction of gender and ethnicity was significant, the main effects of gender and ethnicity were not tested for. Please see Figure 5 in Appendix B for an ANOVA table of the results. Table 2.5 displays the mean ethnic identity score by gender and ethnicity.

Gender/Ethnicity	White	Multiracial	Hispanic	African American
Male	31.17	31.88	35.33	33.68
Female	30.86	33.20	34.73	38.79

Table 2.5: Mean Ethnic Identity Scale Score by Gender and Ethnicity

Post-hoc analyses using Bonferroni adjusted correction were carried out to identify significant differences among groups by holding gender and ethnicity at certain levels. Comparing gender at

each level of ethnicity, African American females were found to have statistically higher rates of ethnic identity compared to their male peers of the same race. No other statistically significant differences were found between the sexes for the other races. Hispanic males had statistically higher ratings of ethnic identity compared to males in both White and Multiracial ethnic groups. These were the only significant differences found among the ethnic groups for male students. Black females had statistically higher self-ratings of ethnic identity than their female peers of all other races. White females had statistically lower ratings of ethnic identity compared to Multiracial and Hispanic females. The scale score did not differ significantly between Multiracial and Hispanic females. Please refer to Table 3 in Appendix B for a p-value matrix that was used to arrive at these conclusions.

The post hoc analysis results differed from that obtained by Booth and her fellow researchers [5]. In the 2014 article, the researchers only found a statistically significant difference in the ethnic identity survey responses of African American and White males (with African American having higher self-ratings). Among females, the researchers highlighted that African American females displayed stronger ratings on ethnic identity than Multiracial and White females which was found this study. However, they did not find a statistical difference between African American and Hispanic females. Finally, they found that Hispanic females displayed statistically higher ratings of ethnic identity compared to Multiracial females which was not found in this study. The differences could be for a number of reasons. Booth and her fellow researchers ran three separate ANOVA models and used the 14 item scale. In addition, a different sample of students was examined.

Analysis of Variance Diagnostics

A check on the assumptions of the ANOVA model yielded some interesting findings. One assumption is that independent random samples were taken from k normally distributed populations. The normal probability plot of the residuals provided in Figure 2.3 indicated that the distribution of residuals had heavy tails. There were a number of extreme scales on either end; however, a non-parametric ANOVA permutation test provided identical results to the parametric ANOVA (gender

and ethnicity interacted to affect the scale score significantly, p-value = 0.001). The permutation test does not assume that the data are normally distributed. The test randomly permutes observations to the treatments and each time calculates the F test statistic. The test statistics are compiled to calculate a p-value to decide whether to reject the claim that the means differ for the populations of interest [30]. The results of the permutation test are provided in Figure 6 in Appendix B.

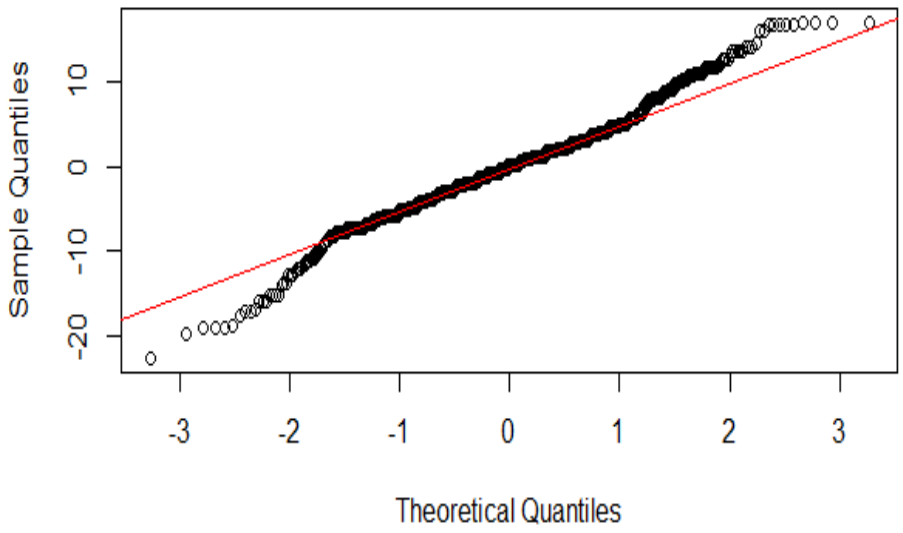

Figure 2.3: ANOVA Diagnostic Checks: Normality

Checking another assumption of the ANOVA model, equal variances among treatment groups, also provided some interesting information. The parallel box plots of the ethnic identity scale score broken out by gender and ethnicity provided in Figure 2.4 show that the spread of responses often varied across genders and ethnic groups. The two extremes appeared for African American males and females (groups 1 and 5, respectively). African American males had a very small spread in their responses of ethnic identity compared to their females in the same race that had a wide spread in their responses. While the spread differed among the eight gender/ethnicity groups, it was not found to be significant (Levene's Test: p = 0.157). Finally, there was a number

of outlying responses for all ethnic groups on both ends of the scale which explains the heavy tailed residuals. The largest number of outliers appeared for White students (groups 3-males and 7-females); however, this is expected as White students made up most of the sample.

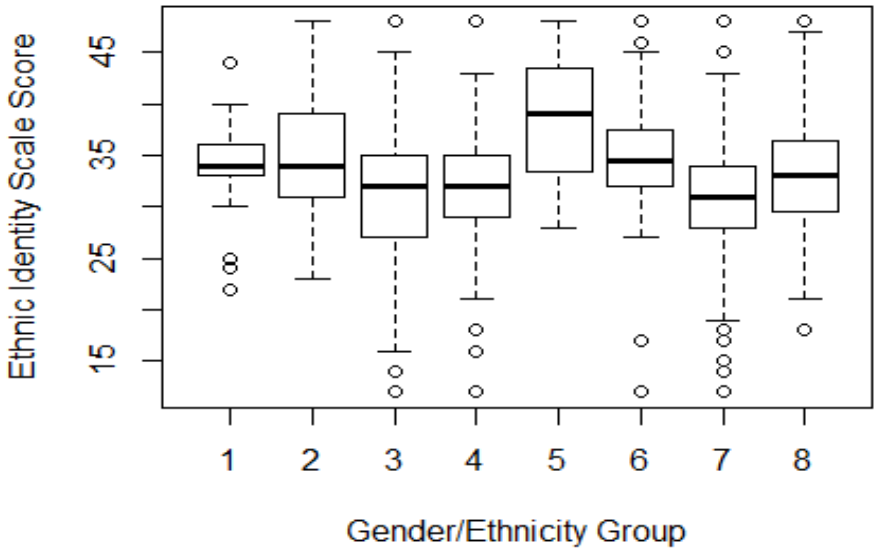

Figure 2.4: ANOVA Diagnostic Checks: Equal Variance of Treatment Groups

2.3 Changes in Ethnic Identity Scale Score: Fall 2010-Spring 2012

2.3.1 Methodology and Study Participants

Two interesting follow-up questions to the fall 2010 analysis were the following: to what extent do students change their ratings of ethnic identity as they age and is there a stronger change for a particular group of students? Changes in the mean ethnic identity scale score were examined from fall 2010 to spring 2012 (4 semesters of data) with a repeated measures analysis of variance. In addition, a separate analysis on the variation of student responses of ethnic identity was explored. While student responses of ethnic identity were available for the 2012-2013 academic year, data from this year were not used as it would have led to a substantial decrease in sample size (students who were in eleventh grade in fall 2010 graduated in May 2012).

Only 340 students were included in the change analysis because these students had scale score data for all four semesters. Of the 340 students, 157 were male and 183 were female. The sample sizes for the specific ethnic groups were the following: 15 African American, 37 Hispanic, 220 White, and 68 Multiracial. The small sample sizes for some of the ethnic groups made it difficult to examine changes in ethnic identity by both gender and ethnic group. An initial analysis showed minimal changes in the ethnic-identity self ratings by gender. Thus, both analyses examined changes in ethnic identity among ethnic groups only.

2.3.2 Repeated Measures Analysis of Variance

A repeated measures analysis of variance procedure was carried out to investigate whether students significantly changed their ethnic identity ratings over the four semesters of interest. Self-ratings of ethnic identity were collected for each of the 340 students from fall 2010 to spring 2012. A within-subjects factor of time was considered to compare the mean scale score over the four semesters. The fall 2010 analysis suggested that the mean scale score differed among the ethnic groups. To investigate whether this phenomenon was consistent over time, a between-subjects factor of ethnicity was used to compare the mean scale score among the groups of students. Finally, a factor representing the interaction of time and ethnicity was utilized to test whether the scale score changed differently for the ethnic groups in the analysis. The Greenhouse and Geisser statistic was 0.9436, so the univariate repeated measures model was preferred. This yielded the following model:

$$Y_{ijr} = \mu + B_i + S_{(i)j} + A_r + BA_{ir} + \epsilon_{ijr},$$

where $i = 1, 2, 3, 4$, $j = 1, 2, \ldots, n_i$, and $r = 1, 2, 3, 4$. The factor B represented the between subjects factor of ethnicity, factor A represented the within subjects factor of time, and factor BA represented the interaction of ethnicity and time. The students are nested within the ethnic group; hence, represented as $S_{(i)j}$. The interaction of A and S combined for the error term.

The interaction of time and ethnicity was not significant suggesting that the change in the ethnic identity scale score did not differ significantly among the ethnic groups included in the study. In

addition, the time effect was not significant showing that students did not significantly change their ratings of ethnic identity over the two year period. However, the between subject factor of ethnicity was significant ($F = 9.68$, $p < 0.0001$). In other words, the ethnic identity scale score continued to differ among the ethnic groups included in the analysis. Please see Figure 7 in Appendix B for an ANOVA table of the results. The mean ethnic identity scale score by ethnic group is plotted over time in Figure 2.5. While the change in the mean scale score was not significant over time, it did appear that Non-White students tended to vary their self-ratings of ethnic identity from semester to semester more than White students. Hispanic students had the highest ratings of ethnic identity for all semesters.

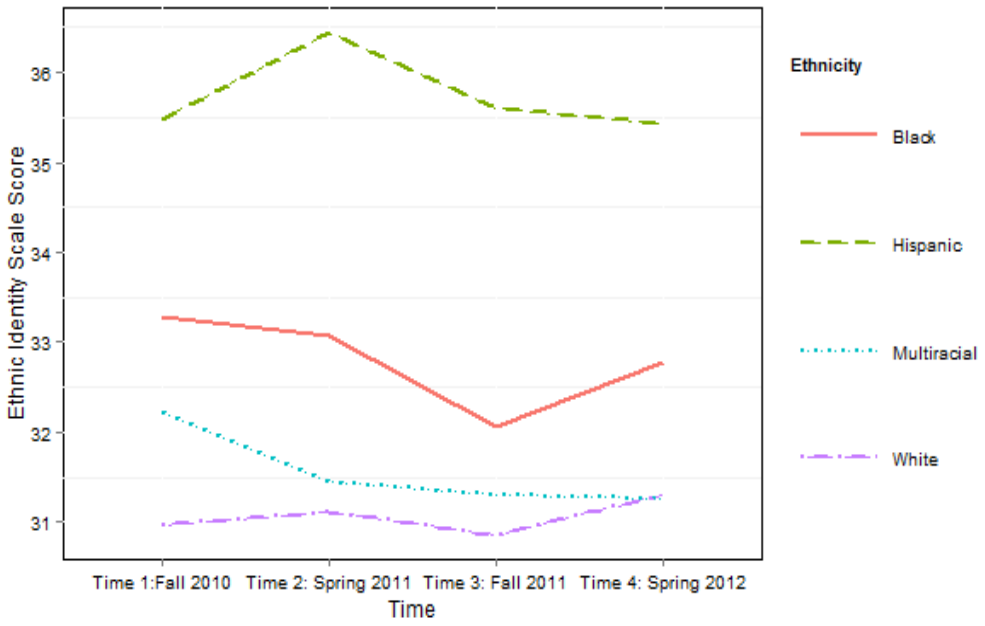

Figure 2.5: Mean Ethnic Identity Scale Score by Ethnic Group and Semester

As was the case in the fall 2010 analysis, the scale score was not normally distributed. This was especially the case for the scale for the White ethnic group. For all semesters, the scale was heavy tailed with a number of extreme ratings of ethnic identity on both sides of the scale. A normal probability plot of the spring 2012 scale for White students is given in Figure 2.6. The results of the repeated measures analysis may not be valid and should be taken with caution.

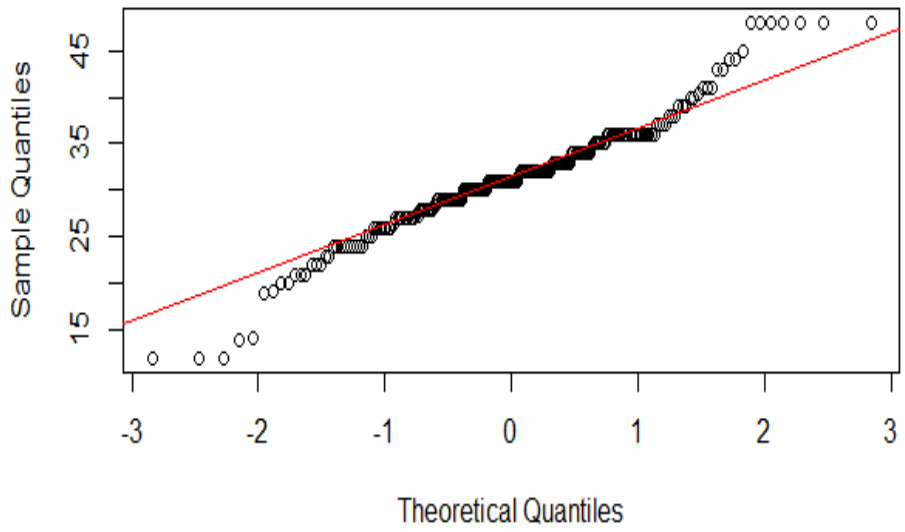

Figure 2.6: Normal Probability Plot of Spring 2012 Scale Score for White Students

2.3.3 Exploratory Approach

The repeated measures analysis of variance showed no significant change in the mean scale score over time for students in the district. However, it was apparent that students from non-White ethnic groups were more likely to differ their ratings of ethnic identity than White students from semester to semester. A random sample of five students from each ethnic group was taken and their scale score is plotted over time in Figure 2.7. Each line represents the behavior of the ethnic identity scale score for a single student. The more movement in the score, the larger variation and thus, larger change in ethnic identity for that student.

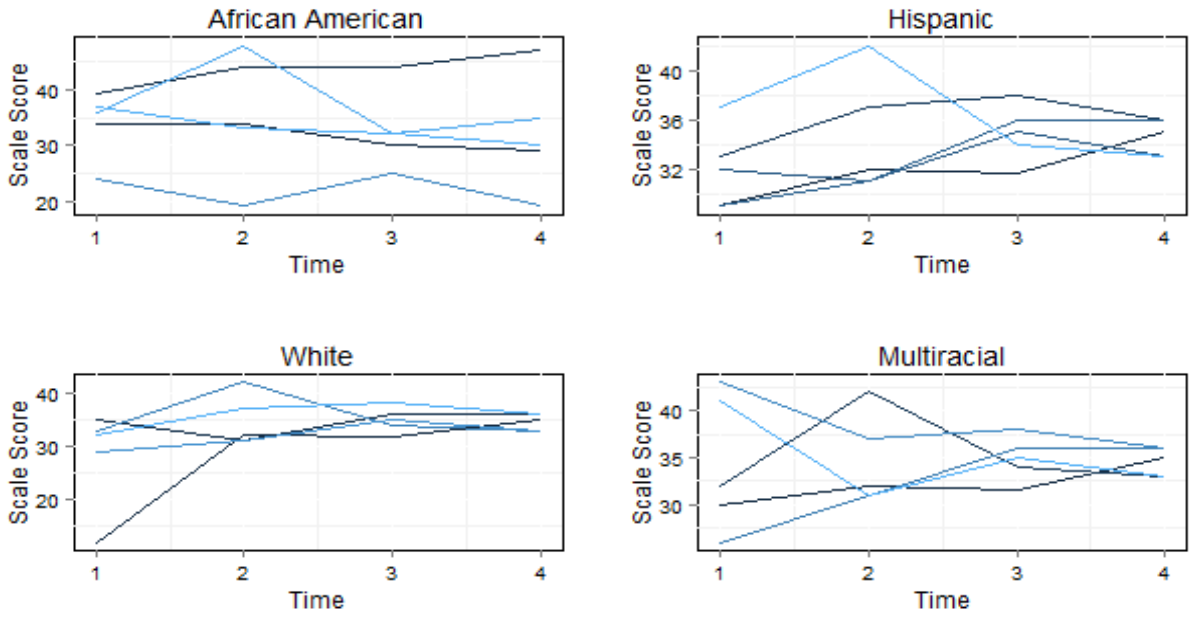

Figure 2.7: Ethnic Identity Scale by Ethnic Group and Semester: Random Sample of 5 Students

To measure variation of the scale over the four semesters, the standard deviation was computed for the four data points for each of the 340 students. Parallel boxplots displaying the distribution of the standard deviation of the scale by ethnic group is provided in Figure 2.8. For all ethnic groups, the distribution of the standard deviation was right skewed with few students making large movements in their ratings of ethnic identity. Hispanic, Multiracial, and White students had at least one student vary their score significantly more than the group overall, with White students having the most of these cases. The median and interquartile range by ethnic group are provided in Table 2.6. Non-White students tended to vary their responses of ethnic identity slightly more about their average responses compared to White students. Among all ethnic groups, African American and Multiracial students had the highest median standard deviation, deviating their score 2.94 points about their typical score in four semesters.

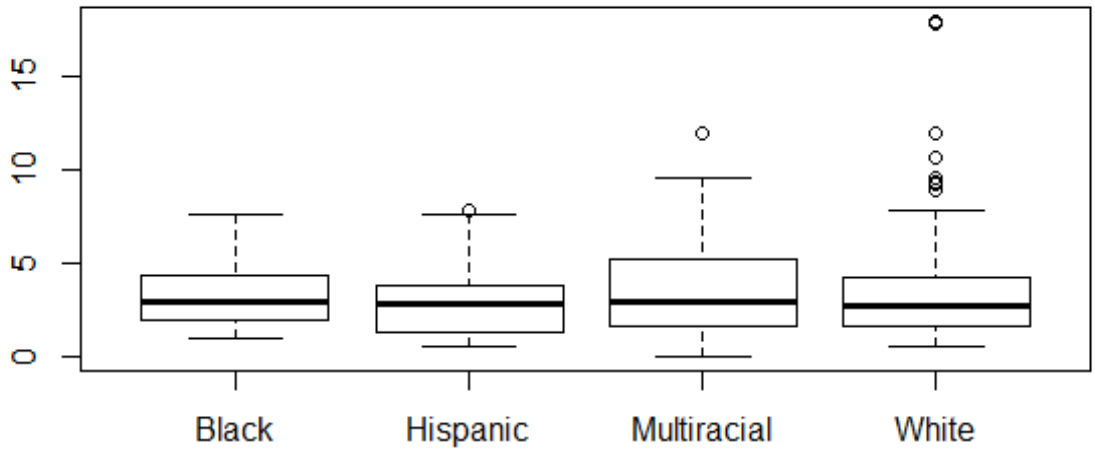

Figure 2.8: Parallel Boxplots of Standard Deviation in Scores by Ethnic Group

Statistic/Group	Black	Hispanic	Multiracial	White
Median	2.94	2.87	2.94	2.73
IQR	2.38	2.57	3.47	2.59

Table 2.6: Median and Interquartile Range of Standard Deviation of Scale Score

2.4 Summary of Results and Possible Future Study

The results of the ethnic identity analysis provide insight into the connection that students in the district feel toward their ethnic group. African American and Hispanic students reported higher ratings of ethnic identity compared to Multiracial and White students in the district. This observation is consistent with literature that suggests that ethnic identity development is the strongest for students of the ethnic minority [45] [34]. With the exception of Native American and Asian/Pacific Islander ethnic groups, African American and Hispanic students made up the smallest share of total enrollment in the district. For these students, the cultural differences of their own ethnic group compared to the majority culture may have fostered an additional sense of belonging and

pride toward their own ethnic group and/or prompted additional search to learn more about their ethnic background.

The strength of ethnic identity also differed by ethnicity within gender groups. Hispanic males rated themselves statistically higher on the ethnic identity scale compared to their White and Multiracial male peers. More pronounced differences in ethnic identity ratings were found among the ethnic groups for female students. The scale differed by nearly eight points between White and African American females who displayed the lowest and highest ratings of ethnic identity, respectively. White females had statistically lower feelings of ethnic identity quantified by the MEIM scale compared to females of all other races. Multiracial and Hispanic females were found to be on similar levels of ethnic identity formation according to the MEIM scale but higher than that of White females. African American females displayed even stronger feelings of ethnic identity by rating themselves nearly four additional points higher on the scale compared to their female classmates who did not identify as White.

The fall 2010 analysis also suggests a discrepancy in the ethnic identity scale between African American males and females in the district. African American females rated themselves nearly 5 points higher on the ethnic identity scale than their male classmates in the same ethnic group. Literature suggests that this difference may be due to possible perceived discrimination [10]. Research has shown that an important part of ethnic identity development for African American males is associated with overcoming obstacles related to ethnic tension and searching for equality [10] [8]. Possible perceived discrimination and negative comments from members of the community and school peers could be preventing African American males from reaching levels of ethnic identity formation equal to that of African American females in the district. However, this interpretation should be taken with caution and further investigation is warranted. Regardless, the high score for African American females suggests strong, positive ties to African American tradition and customs for these females in the district. Research has shown that these are key components of ethnic identity achievement for African American females [10] [8].

The longitudinal analysis of the scale did not show a significant change or development in

ethnic identity for students from fall 2010 to spring 2012. However, it did appear that Non-White students varied their self-ratings of ethnic identity more than White students over the four semester period. This shows that Non-White students may be giving more thought into developing their of ethnic identity and connecting to their ethnic group, though it was not statistically significant. If future study allows, examining changes in the MEIM scale between the transition from middle school to high school could be carried out. Recent research has shown that this transition may be a crucial component of ethnic identity formation for minority adolescents [16] [17].

There may be limitations to the results of the longitudinal study. Firstly, it was assumed that the times of data collection between semesters was the same; in reality, the survey was likely given at different times each semester. Another potential limitation is the small longitudinal sample. African American students had an average of about 36 on the ethnic identity scale in the fall of 2010; however, for the longitudinal analysis, the mean scale for this ethnic group was nearly three points lower for the same semester (see Figure 2.5). The discrepancy in the score for African American students may suggest that the sample of students examined longitudinally may not reflect the entire ratings of the group as a whole. In actuality, this may be the case for all ethnic groups as the sample size was considerably smaller examining the score over time. In addition, the fact that the scale score differed by both gender and ethnicity in fall 2010 and it was not examined so over time may be a problem. Ratings of ethnic identity may have gone in either direction between the genders in the same ethnic group.

As a part of the limitations described above, imputation is a recommendation for future longitudinal research on the scale. However, this likely will come with limitations when interpreting the results. An iterative imputation method using a randomized complete block design was considered to estimate missing scale data to add students who had only one semester of missing data into the analysis [30]. The semesters were considered as treatments and the individual students were considered as blocks. Using the overall trends in the scale for the students in the district, scales were guessed for all students except one, and three iterations were used until estimates of the scales converged. A repeated measures analysis of variance was conducted on the new sample of students

and even before adjusting for the degrees of freedom lost in estimating the missing scales, no statistically significant developments were found in the ethnic identity scale over the four semesters. Since the results did not change and the sample of students increased by 1.8 times (340 students to 607 students), which would have caused implications for interpretation, these results were not presented. Longitudinal research on the scale will be difficult because a number of students could have missing data due to school absence, mobility out of the district, and potential drop-outs for older students.

CHAPTER 3 ETHNIC/RACIAL SELF-CLASSIFICATION ANALYSIS

3.1 Methodology and Initial Sample

In this study, changes in the ethnic/racial self-classification of students were examined. Surveys were administered to students in each fall and spring semester from fall 2009 to spring 2013. While data were available for four school years, only three school years or six semesters of data were utilized (fall 2009 to spring 2012). The primary motivation for this methodology was that an entire class of students graduated the spring before the last two semesters of data collection. Including the last two semesters of data collection in the analysis would have underestimated the number of changes in self-classification for the students who graduated because they had less time to be observed in the study. Using self-classification data for the first three school school years provided a standardized time frame to observe changes in ethnic/racial self-classification.

To be included in the study, a student needed to have ethnicity data for at least four semesters. The four semester rule was utilized because the majority of students (roughly 60%) had ethnicity data for four time points. In addition, using four semesters of data allowed the study of changes in classification over a minimum of two school years for each student. This provided a suitable length of time for a student to give thought into changing his or her ethnic/racial classification. Finally, the student needed to have reported their ethnicity in the fall of 2009, the initial semester of data collection, to be included in the study.

The above methodology yielded an initial sample size of 755 total students. Table 3.1 breaks down the sample size by ethnicity, gender, and grade level reported in fall 2009. Among those 755 students, 5 did not report their gender and 6 did not report their grade level in fall 2009. These eleven students were removed from analyses in which gender, grade level, and ethnicity were required. In addition, the sample sizes for Native American and Asian/Pacific Islander ethnic groups were small, and these students were removed from certain analyses.

Group	Sample Size
Native American	10
Asian/Pacific Islander	3
African American	50
Hispanic	79
White	464
Multiracial	149
Male	370
Female	380
Grade 7	210
Grade 8	209
Grade 9	214
Grade 10	116

Table 3.1: Sample Sizes by Group

3.2 Number of Changes in Ethnic/Racial Self-Classification

The number of changes in ethnic/racial self-classification was computed for each student. Whenever a student had missing ethnicity data for a semester, the last self-classification was referenced to determine whether a change occurred. Table 3.2 provides the frequency and relative frequency of the number of changes in ethnic/racial self-classification. The majority of students did not change their self-classification of ethnicity while in the study. Among the students who did vary their ethnicity over the six semesters, most changed classification one or two times. A handful of students changed their ethnic/racial self-classification four times.

Statistic/Number of Changes	0	1	2	3	4
Frequency	576	78	73	22	6
Relative Frequency	76.3%	10.3%	9.7%	2.9%	.8%

Table 3.2: Frequencies & Percentages: Number of Changes in Ethnic/Racial Self-Classification

3.3 Modeling Changes in Ethnic/Racial Self-Classification

While the majority of students did not change their ethnic/racial classification, there were 179 or twenty-four percent of the students in the study who did change classification at least once.

How did these students differ from those who did not change classification? Two models were fit to the data to provide additional information about those students changing classification: a logistic regression model and an ordinal logistic regression model.

3.3.1 Candidate Predictor Variables and Hypotheses

Demographic Predictor Variables

The student's self-reported gender and ethnicity for the fall 2009 AACS survey were considered as demographic predictor variables. Two variables were collected from the AACS survey that measured the age of the student: the student's self-reported age and grade level. It was decided to use grade level instead of age for a number of reasons. The first reason was that fewer students had missing data for grade level than age, allowing more of the initial sample of students to be included in the analysis. The second reason was that the sample of students was so similar in age that age would not provide much differentiation (the majority of students differed by at most four years in age). As an example, there could be a student in eighth grade that is the same age as a student in ninth grade. However, the school environments and interactions with peer classmates may be very different which could affect changing ethnic/racial self-classification; grade level might capture such information.

Since previous research suggests that Multiracial adolescents show less consistency in self-reports of ethnicity [18] [12] [27] and these adolescents naturally have more options when selecting ethnic/racial categories than adolescents of monoracial ethnic groups, it was hypothesized that students who self-reported as Multiracial in fall 2009 would be the most likely to change ethnic/racial self-classification. A literature review by Doyle and Kao in their study on changes in ethnic/racial self-classification reflected that females tend to internalize comments related to race and skin color more than males and tend to be more sensitive to negative comments about race [12]. Since such feelings could contribute to changes in ethnic/racial self-classification, it was hypothesized that females would be more likely to vary their self-report of ethnicity than males in the study. Two studies using data from the National Longitudinal Study of Adolescent Health found that the odds

of changing ethnic/racial self-identification did not differ significantly by the age of the adolescent [20] [12]. However, the estimated odds ratios from the logistic regression models were less than one implying that younger students were more likely than older students to change ethnic/racial self-classification. This makes logical sense as younger adolescents are just beginning to develop their sense of identity [13] and are beginning to make decisions about how to define themselves such as choosing an ethnic group to belong to. It was hypothesized that younger students (students in grades 7 and 8) would be more likely to change ethnic/racial self-classification than older students (students in grades 9 and 10).

Survey Scale Variables

Additional information was collected from the fall 2009 AACS survey that could provide context for why students were changing classification. Four survey scales from the fall 2009 AACS survey measuring self-esteem ($\alpha = .845$), hope ($\alpha = .870$), feelings toward school ($\alpha = .946$), and perceptions of school environment ($\alpha = .916$) were considered as socio-emotional predictors of ethnic/racial self-classification. A scale was computed for the student if he or she answered at least 75% of the items in the section. Students were asked to rate themselves on the four-level Likert scale for all items in a section. Negatively phrased items were reverse coded before averaging across all items to obtain the scale measures. The survey section items are provided in Appendix A.

A 2006 study by Hitlin, Brown, and Elder using data from the National Longitudinal Study of Adolescent Health found that higher ratings of self-esteem were associated with a decrease in the odds of changing ethnic/racial self-classification [20]. This phenomenon makes sense as if an adolescent has positive feelings about himself or herself, he or she would be less likely to make a large change such as changing his or her ethnic/racial self-classification. A similar hypothesis could be formed about hope. If an adolescent has strong feelings of hopefulness, he or she might be less likely to make a change with the intention of making things better in the future. A 2001 study by Johnson, Crosnoe, and Elder on students' attachment to school and belonging, defines

school attachment as the following (p. 320) (also cited in a study by Burke and Kao on p. 752): "[It is] the extent in which students feel they are embedded in and a part of their communities" [25] [9]. If the adolescent feels that he or she is a part of the school community and/or feels represented in the school community (high ratings of feelings toward school and school environment), he or she may be less likely to change ethnic/racial self-classification.

3.3.2 Study Participants

Of the 755 students in the original sample, 23 students were removed from the modeling analysis because they self-identified as Native American or Asian/Pacific Islander and/or did not report their gender or grade level in the fall 2009 AACS survey. An additional fourteen students were removed because they did not answer at least 75% of the items in the self-esteem, hope, school attitude, and school climate sections of the AACS survey. This gave a sample of 718 students to model changes in ethnic/racial self-classification. There were slightly more females than males in the sample: 364 females and 354 males. The sample sizes for the African American, Hispanic, White, and Multiracial ethnic groups were the following: 47, 78, 448, and 145. The sample was skewed toward younger adolescents, with grade 10 students making up the smallest share of the sample; the sample sizes were 198, 198, 207, and 115 for grades 7, 8, 9, and 10, respectively.

3.3.3 Model Building Strategy

The goal was to create a model to explain the likelihood of changing ethnic/racial self-classification with the fewest set of predictors possible. The model needed to have a suitable number of predictors to fit the data well but also be as simple as possible for interpretation purposes. The first step was to identify variables that by themselves were related to the response. To do this, the candidate variables were flagged through simple logistic and ordinal logistic regression models with a criterion that the Wald p-value needed to be 0.20 or less. Predictors that met the criterion were then pooled together to form an initial multiple logistic and ordinal logistic regression model. Then, a backward stepwise selection method using Akaike Information Criterion (AIC) was carried out to remove variables that did not add significant prediction in changing ethnic/racial self-classification.

AIC chooses the best model based on how close the the fitted values are compared to the true values and penalizes a model for additional variables that do not add significant prediction [1]. The best model was the one that minimized AIC. Whenever the AIC decreased when removing a variable, it indicated that the variable should be removed. However, when AIC increased when removing a variable, that variable was suggested to be retained. All possible four variable (three demographic variables and one scale variable) and five variable (three demographic variables and two scale variables) models were constructed and compared to the refined model to choose the best model for the study.

3.3.4 Logistic Regression Model

The logistic regression model modeled the log odds of the ith student changing ethnic/racial self-classification at least once while in the study. The outlined model building strategy yielded a model with gender, ethnicity, grade level, and the hope scale score as covariates (-2LogL = 669.609, G^2 = 109.260, p-value = $<$0.0001). Please refer to Tables 4-10 in Appendix B for summary information that was used to arrive at the model. Female, grade 10, and White students were found to be the least likely to change their ethnic/racial self-classification, so these levels were utilized as reference classes to make comparisons. In addition, the hope scale score was standardized for easier interpretation. This gave the following model for the study:

$$\text{logit}(p_i(\mathbf{x_i})) = \ln(\frac{p_i(\mathbf{x_i})}{1-p_i(\mathbf{x_i})}) = -3.277 + 0.806X_1 + 1.132X_2 + 1.345X_3 + 0.652X_4 + 1.342X_5 + 1.238X_6 + 1.753X_7 - 0.188X_8, \text{ where}$$

$X_1 = 1$ if student is male, 0 if student is female;

$X_2 = 1$ if student is in Grade 7, 0 otherwise;

$X_3 = 1$ if student is in Grade 8, 0 otherwise;

$X_4 = 1$ if student is in Grade 9, 0 otherwise;

$X_5 = 1$ if student is African American, 0 otherwise;

$X_6 = 1$ if student is Hispanic, 0 otherwise;

$X_7 = 1$ if student is Multiracial, 0 otherwise; and

$X_8 =$ standardized hope scale score.

Summary information for the model is provided in Table 3.3. The exponentiated coefficients gave the estimated odds ratios for changing ethnic/ethnic racial self-classification when moving from the reference classes and varying the hope scale score. The SAS model output was rounded to three decimal places, so some of the exponentiated coefficients may differ slightly from the reported odds ratios. Contrary to what was hypothesized, males were more likely than females to change their ethnic/racial self-classification while in the study. The odds of changing ethnic/racial self-classification for male students were estimated to be at least 1.5 times and up to 3.3 times the odds of changing ethnic/racial self-classification of female students when holding grade level, ethnicity, and the hope scale score constant.

Younger students were more likely to change ethnic/racial self-classification than older students in the study. These results are consistent with the results of the two Add Health research studies [20] [12]; however, these results were statistically significant compared to results of the previous studies that were not. Students who began the study in eighth grade were the most likely

Parameter	Coefficient	S.E.	Odds Ratio (Reference Class)	95% Wald C.I. for Odds Ratio
Intercept	-3.277	0.354	-	-
Male	0.806	0.200	2.238 (Female)	(1.514, 3.309)
Grade 7	1.132	0.349	3.101 (Grade 10)	(1.566, 6.141)
Grade 8	1.345	0.346	3.837 (Grade 10)	(1.946, 7.565)
Grade 9	0.652	0.354	1.920 (Grade 10)	(0.960, 3.840)
Black	1.342	0.348	3.828 (White)	(1.934, 7.577)
Hispanic	1.238	0.289	3.447 (White)	(1.956, 6.074)
Multiracial	1.753	0.227	5.769 (White)	(3.699, 8.999)
Hope Scale	-0.188	0.099	0.828(-)	(0.682, 1.006)

Table 3.3: Logistic Regression Model Results

to vary their ethnicity rating at least once while in the study, having an estimated odds of changing classification between roughly two and eight times larger than that of grade 10 students. The odds of changing ethnic racial self-classification were estimated to be roughly 3 times larger for seventh grade students compared to tenth grade students. Students who began the study in ninth grade did not differ significantly in their odds of changing classification compared to their classmates a grade above them. These interpretations held given the student's gender, ethnicity, and feelings of hopefulness were fixed.

Non-White students were more likely to vary their ethnicity classification while in the study compared to White students. Students who self-reported their race as Multiracial at the beginning of the study had the highest odds of changing ethnic/racial self-classification. The odds of a student who self-reported as Multiracial in fall 2009 of changing ethnic/racial classification were between 3.7 and 9 times higher than a student who self-reported as White. Black and Hispanic students appeared to be on similar levels in their odds of varying their ethnic/racial self-classification. Students who self-reported as Black or Hispanic in fall 2009 had an estimated odds of changing classification 3.8 and 3.5 times larger, respectively, than their peer classmates who self-identified as White when holding gender, grade level, and the hope scale score constant.

Higher ratings of hopefulness were likely to foster consistency in self-reports of ethnicity for students in the study. For each standard deviation increase in the scale score, the odds of changing

ethnic/racial self-classification were expected to decrease by a factor of 0.83 when fixing the gender, grade level, and ethnicity of the student. In other words, for each additional standard deviation increase in the scale score, the odds of varying self-reports of ethnicity reduced by 17%. The effect of the hope scale on the probability of changing ethnic/racial self-classification was not quite significant at the five percent significance level (p-value = 0.057).

The coefficients of the logistic regression model were utilized to calculate probabilities of a student in the study changing ethnic/racial self-classification at least once in the study given the student had certain characteristics. The following formula was utilized to calculate the probability that the ith student changing ethnic/racial self-classification at least once while in the study:

$$p_i(\mathbf{x_i}) = \frac{\exp(\alpha+\mathbf{x_i}'\boldsymbol{\beta})}{1+\exp(\alpha+\mathbf{x_i}'\boldsymbol{\beta})}, \text{ where}$$

α is the intercept, $\mathbf{x_i}$ is the ith student's covariate vector of characteristics, and $\boldsymbol{\beta}$ is the vector of coefficients for the covariates. The estimated probability of changing classification one or more times for a White female student in grade 10 who had a hope scale score at the mean was given by

$$\frac{e^{-3.277}}{1+e^{-3.277}} = .036.$$

It was highly unlikely that a student with such characteristics would change her self-report of ethnicity while in the study. However, a male student that began the study in grade 8 who self-reported as Multiracial and had a hope scale score one standard deviation below the mean was highly likely to change what ethnicity he identified as. The estimated probability of changing ethnic/racial self-classification at least once for student with these characteristics was given by:

$$\frac{e^{-3.277+0.806+1.345+1.753+0.188}}{1+e^{-3.277+0.806+1.345+1.753+0.188}} = \frac{e^{.815}}{1+e^{.815}} = .693.$$

3.3.5 Ordinal Logistic Regression Model

Binary logistic regression was used to model the probability of changing ethnic/racial classification one or more times versus the probability of not changing classification at all. A good number of students changed classification two, three, or even four times. Collapsing these multiple categories into a single change category could result in a significant loss of information. The response was ordered (0 changes $<$1 change $<$2 changes $<$3 changes $<$4 changes), so an ordinal regression model was more appropriate to model the cumulative probabilities of these individual events. Since the counts of 3 or 4 changes were too small to consider certain groups of students in the model, the ordinal logistic regression model modeled the cumulative probabilities of the following ordered events: no change, 1 change, and 2 or more changes. The model building strategy yielded a model for the study with gender, ethnicity, grade level, and the school attitude scale as predictors of changing ethnic/racial self classification (-2LogL = 898.766, G^2 = 106.553, p-value = $<$0.0001). Please refer to Tables 11-16 in Appendix B for summary information that was used to arrive at the model. Female, grade 10, and White students were used as reference classes, and the school attitude scale was standardized for easier interpretation. The model for the study is outlined below (p_{i2} denoted the probability that the ith student changed classification 2 or more times and p_{i1} denoted the probability that the ith student changed classification 1 or more times) :

$$\text{logit}(p_{i2}(\mathbf{x_i})) = \ln(\frac{p_{i2}(\mathbf{x_i})}{1-p_{i2}(\mathbf{x_i})}) = -3.857 + 0.671X_1 + 1.082X_2 + 1.226X_3 + 0.554X_4 + 1.337X_5 + 1.153X_6 + 1.714X_7 - 0.173X_8,$$

$$\text{logit}(p_{i1}(\mathbf{x_i})) = \ln(\frac{p_{i1}(\mathbf{x_i})}{1-p_{i1}(\mathbf{x_i})}) = -3.114 + 0.671X_1 + 1.082X_2 + 1.226X_3 + 0.554X_4 + 1.337X_5 + 1.153X_6 + 1.714X_7 - 0.173X_8, \text{ where}$$

$X_1 = 1$ if student is male, 0 if student is female;

$X_2 = 1$ if student is in Grade 7, 0 otherwise;

$X_3 = 1$ if student is in Grade 8, 0 otherwise;

$X_4 = 1$ if student is in Grade 9, 0 otherwise;

$X_5 = 1$ if student is African American, 0 otherwise;

$X_6 = 1$ if student is Hispanic, 0 otherwise;

$X_7 = 1$ if student is Multiracial, 0 otherwise; and

$X_8 =$ standardized school attitude scale score.

Summary information for the model is provided in Table 3.4. Similar relationships between the odds of changing classification and the demographics of the student were found with the ordinal logistic regression model compared to the logistic regression model. The odds of more changes in ethnic racial classification for males were expected to be roughly twice that of their female classmates when keeping the other covariates fixed. Younger adolescents were more likely to change ethnic/racial self-classification than older adolescents. The odds of more changes in ethnic/racial self-classification were 3, 3.4, and 1.7 times higher for students in grades 7, 8, and 9 than grade 10 when fixing gender, ethnicity, and the school attitude scale score. Similar to the results of the logistic regression analysis, grade 9 students did not differ significantly in their odds of varying their self-reports of ethnicity compared to their peer classmates in grade 10.

Non-White students were more likely to vary their ethnicity classification while in the study

Parameter	Coefficient	S.E.	Odds Ratio (Reference Class)	95% Wald C.I. for Odds Ratio
Intercept 2	-3.857	0.356	-	-
Intercept 1	-3.114	0.343	-	-
Male	0.671	0.191	1.956 (Female)	(1.345, 2.845)
Grade 7	1.082	0.339	2.951 (Grade 10)	(1.518, 5.736)
Grade 8	1.226	0.340	3.406 (Grade 10)	(1.750, 6.629)
Grade 9	0.554	0.349	1.740 (Grade 10)	(0.878, 3.451)
Black	1.337	0.339	3.808 (White)	(1.960, 7.400)
Hispanic	1.153	0.284	3.169 (White)	(1.815, 5.532)
Multiracial	1.714	0.219	5.550 (White)	(3.611, 8.530)
School Attitude	-0.173	0.093	0.842(-)	(0.701, 1.010)

Table 3.4: Ordinal Logistic Regression Model Results

compared to White students. The estimated odds of more changes in ethnic/racial self-classification for African American, Hispanic, and Multiracial students were 3.8, 3.2, and 5.6 times higher than White students, respectively, when holding the other covariates constant. The student's feelings about school that were reported in fall 2009 differentiated those who students who changed ethnic/racial self-classification one or two times versus those students who did not change ethnic/racial self-classification at all. For each additional standard deviation increase in the school attitude score, the odds of more changes in ethnic/racial self-classification were expected to decrease by a factor of 0.84 when fixing the gender, grade level, and ethnicity of the student. In other words, for each additional standard deviation increase in the school attitude scale, the odds of more changes in ethnic/racial self-classification were expected to decrease by 16%. The effect of the school attitude scale on the probability of one or two or more changes in ethnic/racial self-classification was not quite significant at the five percent significance level (p-value = 0.063).

The coefficients were used to predict the probabilities of students changing self-reports of ethnicity one time or two or more times. The probability that a White female student in tenth grade with a school attitude score at the mean would change classification one or more times was estimated to be:

$$\frac{e^{-3.114}}{1+e^{-3.114}} = 0.043.$$

The estimated probability that this student would change two or more times was estimated to be:

$$\frac{e^{-3.857}}{1+e^{-3.857}} = 0.021.$$

This means this student was estimated to have probability of changing ethnic/racial classification one time as 0.043 - 0.021 = 2.2% and two or more times as 2.1%. Using the same comparison example considering a Multiracial male student in eighth grade with now a school attitude scale one standard deviation below the mean scale, it is found that this student was very likely to change ethnic racial classification one or two or more times while in the study. The probability that a student with these characteristics would vary his self-report of ethnicity two or more times was:

$$\frac{e^{-3.857+0.671+1.226+1.714+0.173}}{1+e^{-3.857+0.671+1.226+1.714+0.173}} = \frac{e^{-.073}}{1+e^{-.073}} = .482.$$

The probability that this student would change one or more times was estimated to be:

$$\frac{e^{-3.114+0.671+1.226+1.714+0.173}}{1+e^{-3.114+0.671+1.226+1.714+0.173}} = \frac{e^{.670}}{1+e^{.670}} = .662.$$

This means that a Multiracial male student in eighth grade with a school attitude scale one standard deviation below the mean school attitude scale had an expected probability of changing one time as .662-.482 = 18% and an expected probability of changing two or more times of 48.2%. This student was over 2.5 times as likely to change classification two or more times compared to one time.

3.3.6 Model Comparison and a Note on Assumptions

Both the logistic and ordinal logistic regression models provided similar information for the groups of students that were most likely to vary their self-reports of ethnicity while in the study. Students that were male, young (in grades 7 or 8), and were non-White were the most likely of students to switch classification. The most notable difference between the logistic and ordinal logistic regression models was the survey scale that added additional prediction to whether or

not a student would change ethnic/racial self-classification. The hope scale helped differentiate students in the study who varied their self-report of ethnicity one or more times versus no times. The school attitude scale best helped separate students in the study who changed ethnic/racial self-classification one or two or more times versus no times. The mean scales by zero, one, and two or more changes are provided in Table 3.5 which may provide a possible explanation for why the models differed in the socio-emotional predictor of changes in ethnic/racial self-classification.

Scale	Zero Changes (n=551)	One Change (n=69)	Two or More Changes (n=98)
Hope	3.20	3.13	3.13
School Attitude	2.80	2.77	2.69

Table 3.5: Mean Hope and School Attitude Scale by 0, 1, and 2 or More Changes

Students who changed their classification of ethnicity tended to report lower feelings of hope compared to those students who did not change classification at all; however, those students who changed one time versus two or more times tended to report similar feelings of hopefulness. In other words, the hopefulness measure did not help further separate those who changed their classification once compared to those who changed two or more times. Students who changed their ethnic/racial self-classification during the study also tended to report lower feelings and attitudes toward school; however, the mean school attitude scale continued to decrease as the number of changes increased. The school attitude scale added additional information to separate those who changed their classification one time compared to two or more times while in the study. Negative feelings toward school were more likely to contribute to additional changes in ethnic/racial classification.

While both models provided interesting information about students in the district who were changing classification, the results of the ordinal logistic regression model should be taken with caution. Model checking information is provided for both models in Appendix B (logistic regression model: Figures 10-12 and ordinal logistic regression model: Figures 15-21). The logistic regression model seemed to provide a good fit for the data. However, the ordinal logistic regression model provided a poor fit for students with a higher probability of changing ethnic/racial

self-classification. The ordinal logistic regression model tended to over-approximate the probability of change for these students.

3.4 Semesters that Students Were Most Likely to Change

The logistic and ordinal logistic regression models helped identify the characteristics of students who were most likely to vary their ethnicity rating; however, the models did not provide information on when that change could occur. Identifying semesters for which such a change was most likely could provide additional context for why students were changing classification. To determine semesters that students were most likely to change ethnic/racial classification, estimates of the probability of changing classification were computed for each semester. The probability of changing classification was estimated by computing the quotient of the number of students who changed classification that semester to the total number of students with data for that semester.

Since a large number of students changed their ethnic/racial classification more than once, the probability of changing ethnic classification for the first time was also estimated. This was a conditional probability that represented the likelihood that a student would change his or her classification at time t, given he or she had not changed it yet. This conditional probability was estimated by computing the quotient of the number of students who changed classification at time t to the total number of students with data for that semester and that to semester $t - 1$ had not yet changed their classification. For this study, t = 2, 3, 4, 5, and 6 or t = spring 2010, fall 2010, spring 2011, fall 2011, and spring 2012. The definition of t did not include 1 or fall 2009 as it was impossible to determine if a student changed classification during the first semester of data collection as no previous ethnicity data was available for comparison. These estimates were broken out by the ethnicity and gender reported by the student in fall 2009. For simplicity, these estimates were only plotted. Please refer to Tables 17-36 in Appendix B for the actual estimates and statistical comparisons of the estimated probabilities among the groups.

3.4.1 Ethnicity Reported in Fall 2009

A plot of the estimated probability by ethnicity reported in fall 2009 is given in Figure 3.1. Non-White students had higher probabilities of changing classification for all time points compared to White students. With the exception of time 5, Multiracial students had the highest probabilities of changing classification for all semesters. The probability of changing classification for African American students jumped sharply from time 2 to 3 before decreasing for the remainder of the study. Hispanic students were most likely to see their change at time 5. Error bounds were constructed using the standard error of the probability of change using Bonferroni correction to compare the probabilities of non-White ethnic groups to the White ethnic group. A significant difference was found in the probabilities of change for Multiracial and White students for all time periods. In addition, a significant difference was found in the probabilities of change for Hispanic and White students at time 2. Finally, a significant difference was found in the probabilities of change for African American and White students at time 3. Please refer to Tables 17-21 in Appendix B for summary information regarding the multiple comparison results.

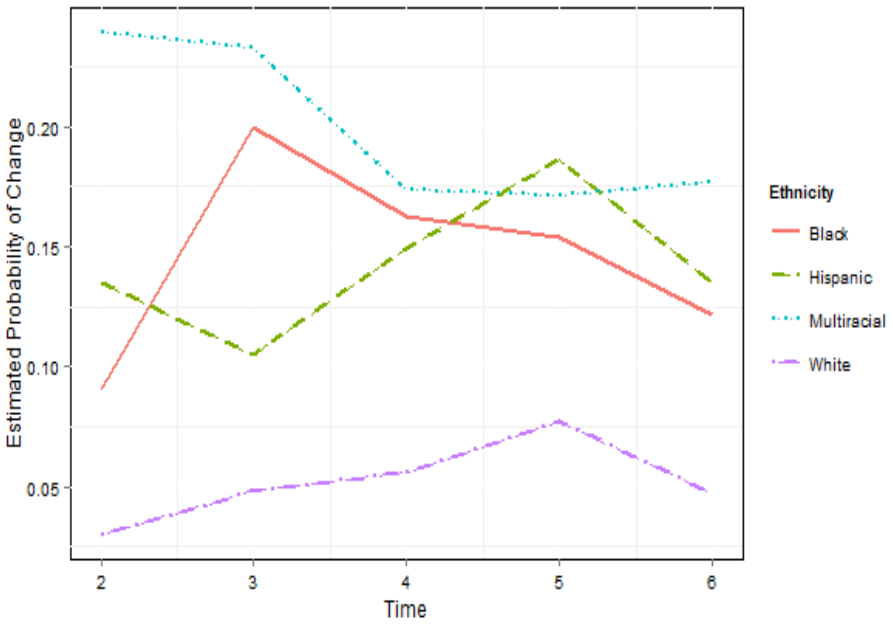

Figure 3.1: Estimated Probability of Changing Self-Classification by Time and Ethnicity

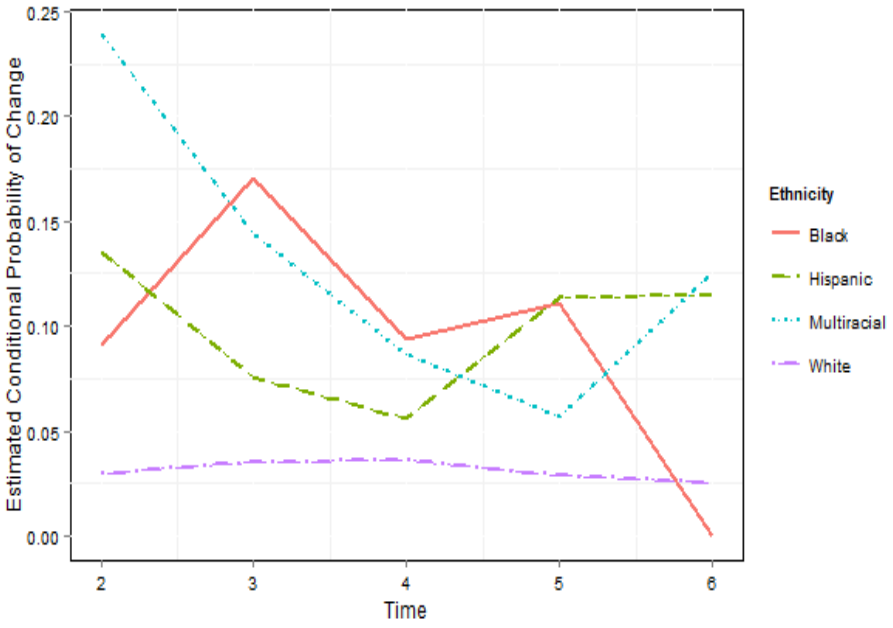

Figure 3.2: Estimated Probability of Changing Self-Classification for the First Time by Ethnicity

A plot of the estimated conditional probability by ethnicity reported in fall 2009 is provided in Figure 3.2. The conditional probability of changing classification for the first time remained consistent for White students at all time points and below five percent. Multiracial and Hispanic students were most likely to change their ethnic/racial classification for the first time from time 1 to time 2. African American students were most likely to change for the first time from time 2 to time 3 with another slight spike in the conditional probability from time 4 to time 5. This is interesting as these were both changes from a spring to a fall semester. Some Hispanic and Multiracial students changed classification for the first time as they exited the study as the conditional probability trended upward from time points 5 and 6. Of those African American students who had not changed classification up to time 5, none changed classification in the final semester of the study. Multiracial students had a statistically higher probability of changing for the first time than White students at times 2 and 3. Hispanic students had a statistically higher probability of changing for the first time than White students at time 2. Finally, White students had statistically higher probabilities of changing classification for the first time than African American students at time 6 (standard error was zero for the proportion of African American students changing classification

for the first time). Please refer to Tables 22-26 in Appendix B for summary information regarding the multiple comparison results.

3.4.2 Gender Reported in Fall 2009

Plots of the estimated probability and conditional probability of changing classification by gender reported in fall 2009 are provided in Figures 3.3 and 3.4. The likelihood of changing classification was higher for males at all time points with the gap in the probability between the genders increasing over time. At time points 4, 5, and 6, there was a statistically significant difference in the probability of changing classification between the sexes. Please refer to Tables 27-31 in Appendix B for summary information regarding the multiple comparison results.

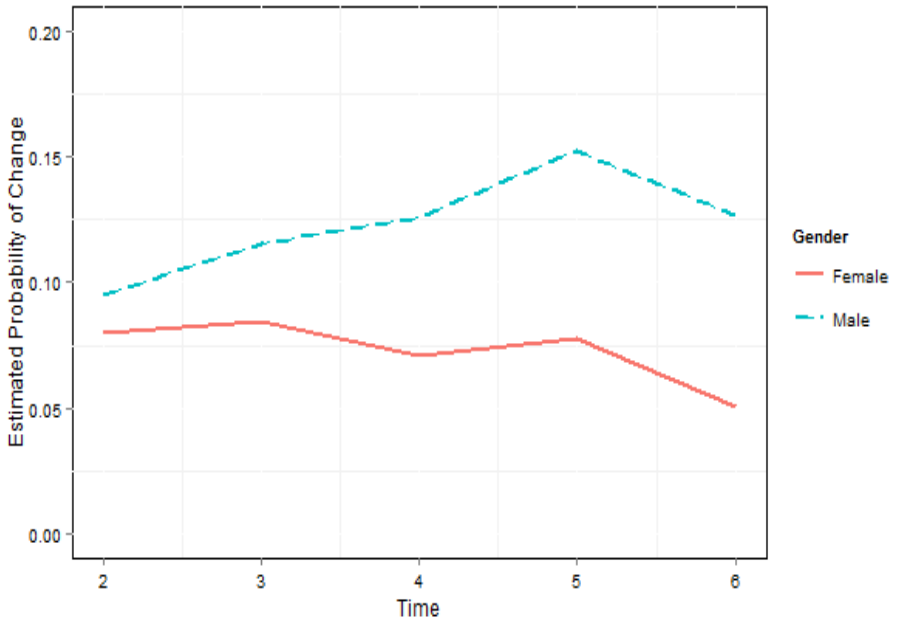

Figure 3.3: Estimated Probability of Changing Self-Classification by Gender

The likelihood of changing ethnic classification for the first time appeared to decrease for both genders as time progressed with boys having higher probabilities of changing for the first time at all time points. The chance of changing self-classification given that it had not changed previously tended to decrease at a higher rate for females as the study progressed. At time points 4, 5, and 6, there was a statistically significant difference in the probability of changing classification for the

first time between the sexes. Please refer to Tables 32-36 in Appendix B for summary information regarding the multiple comparison results.

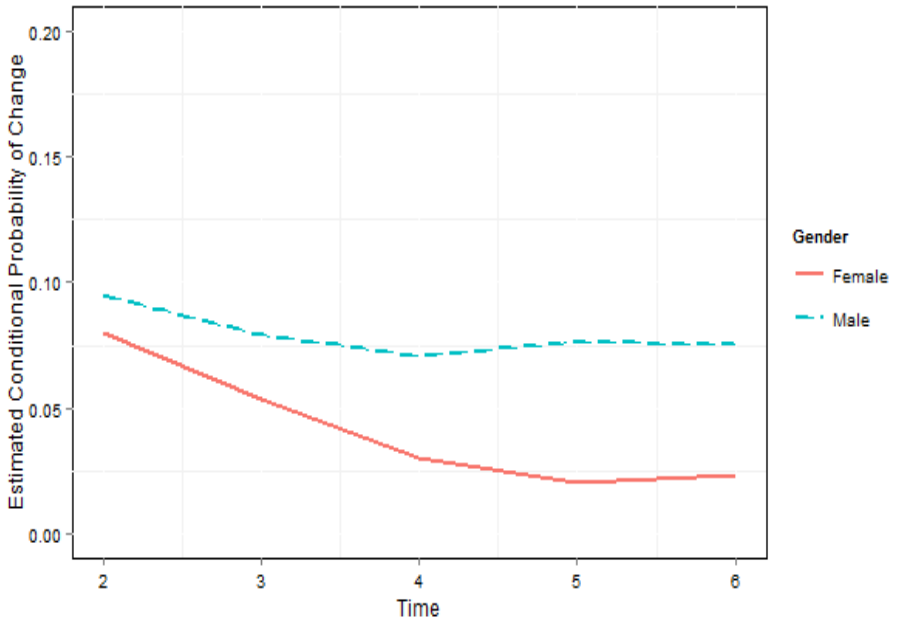

Figure 3.4: Estimated Probability of Changing Self-Classification for the First Time by Gender

3.5 Traffic Patterns Between Ethnicity Classifications

The previous analyses provide insight into types of students who are changing self-classification and when those changes were most likely to occur. An interesting follow up question might be: how do these students end up classifying themselves from the beginning to the end of the study? A two-way table comparing the student's first racial/ethnic classification with the last racial/ethnic classification is provided in Table 3.6. The number to the left of the backslash is the number observed in that cell and the number to the right of the slash is the row or conditional proportion for that cell given their initial classification. For example, of the 10 students classified as Native American at the beginning of the study, 8 classified themselves as White at the end of the study; 8 out of 10 or 80% changed their classification to White. The row proportions may not all sum to one due rounding.

First Classification/Last Classification	N.A.	Asian	Black	Hispanic	White	Multiracial
Native American	0	0	0	0	8/.80	2/.20
Asian	0	3/1	0	0	0	0
Black	0	0	40/.80	0	0	10/.20
Hispanic	0	0	1/.01	61/.77	1/.01	16/.20
White	5/.01	2/0	3/0	3/0	435/.94	16/.03
Multiracial	2/.01	0	5/.04	2/.01	30/.20	110/.74

Table 3.6: Ethnic/Racial Self-Classification: Beginning to End of Study

All of those who reported their ethnicity as Native American in the first semester of data collection changed their self-report of ethnicity by the end of the study. A side analysis of the student's self classification versus the parent's classification of their child's ethnicity suggests that it is possible that these students originally did not understand the meaning of Native American. Of all students who reported their ethnicity as Native American in the fall of 2009, none of their parents registered them in school as Native American in that same school year. Regardless, the high rate of change observed for Native American students is consistent with recent research on changes in ethnic/racial self-classification. The Census Bureau noted that the Native American ethnic group had one of the highest inconsistencies in self-reports of ethnicity from the 2000 to 2010 Census

[27]. Kao and Doyle found that Native American adolescents had the highest odds of changing classification among single-race groups [12]. In contrast to the Native American students who all changed their self-report of ethnicity, all three students who reported their race as Asian/Pacific Islander in the fall of 2009 last reported their ethnicity as Asian/Pacific Islander.

Those who reported their race as Black or Hispanic at the beginning of the study and did change their classification were most likely to self-identify as Multiracial at the end of the study. From the previous analyses, it is not surprising that only a small proportion of those who reported White as their ethnicity in the beginning of the study changing their self-classification by the end of the study. Also expected from previous analyses, those students who reported their ethnicity as Multiracial at the beginning of the study had the highest flow rate to other ethnic classifications at the end of the study; over 25% of students who self-reported as Multiracial in the fall of 2009 changed their self-classification from the beginning to the end. These students were most likely to switch to identifying as White with some switching to Black and Hispanic. When excluding switches to Native American and Asian/Pacific Islander ethnic groups, the lowest flow rates from one ethnicity to another were Black to White, Black to Hispanic, White to Black, and White to Hispanic.

3.6 Summary of Results and Possible Limitations of Study

The results of the ethnic/racial self-classification analysis provide significant insight into changes in ethnic/racial self-classification among adolescents. Nearly a quarter of students varied their ethnicity classification while in the study. These students were more likely to have reported their race as non-White in fall 2009, with the Multiracial ethnic group being the most likely to vary their ethnicity rating. Males and younger students were also more likely to change classification. Two socio-emotional or attitudinal scales were found to predict inconsistencies in self-reports of ethnicity: hopefulness and overall feelings about school. Students with higher scale scores on the hope and school attitude sections of the fall 2009 AACS survey were found to have a decreased odds of changing ethnic/racial self-classification. In particular, the school attitude scale further added prediction to separate those who changed one time versus two or more times; it was the best scale

predictor for the ordinal regression model.

The characteristics of students changing ethnic/racial classification identified through the modelling analysis are both consistent and inconsistent with what has been found in previous research. Previous research has found inconsistencies in self-reports of ethnicity among multi-race groups [27] [12] [20] which was found in this analysis; Multiracial students were found to have the highest odds of changing ethnic/racial self-classification while in the study. The findings in this study by gender differ from that of previous research. Both modeling analyses using data from the National Longitudinal Study of Adolescent Health hypothesized that females would display higher odds of changing ethnic/racial classification (as was hypothesized in this study); however, neither study found a significant gender effect on the likelihood of changing ethnic/racial classification [12] [20]. In this study, the odds of varying self-reports of ethnicity were nearly twice as high for males as the odds of varying self-reports of ethnicity for females which was significant. A similar observation was found for the age effect in the study; younger students were significantly more likely to vary their ethnicity rating over the four semesters. This compared to previous studies that did not find a significant age effect [12] [20].

The plots of the estimated probabilities of changing classification over time yielded some interesting patterns. Regardless of semester, non-White students were more likely to change classification compared to White students. African American students saw spikes in the probability of changing classification for the first time during each of the fall semesters in the study; something may be happening in the summer months to trigger more changes in classification. Both the Hispanic and Multiracial groups had upward trends in the conditional probability toward the end of the study. The gap in the probability and conditional probability increased over time for males and females. If future study allows, further investigation into these longitudinal patterns in the probability of change could be investigated.

Interesting “traffic patterns” were found between ethnicity classifications from the beginning to the end of the study. Students who self-reported as Native American in the fall of 2009 all changed their self-report of ethnicity by the end of the study. The small observed traffic rates from Black

to White, Black to Hispanic, White to Black, and White to Hispanic classifications may be associated with findings in the literature that suggest that physical appearance can affect ethnic/racial classification [12] [19]. Changes between such racial categories may be less permeable because of phenotype. No formal statistical testing was conducted in the two-way table analysis. The responses of beginning classification and ending classification are matched to a single individual student, so the samples were dependent. This prevented statistical testing on the two-way table using a chi-squared test which assumes independent samples. If future study allows, a more sophisticated statistical analysis could be carried out on the two-way table to deal with the dependent samples.

There are a number of limitations to the study. The first limitation is that the sample was made up of predominately younger students. Only 115 students in the modeling analysis were in tenth grade in the fall of 2009, making up only 16% of the total sample. Students in tenth grade in the fall of 2009 might have been more likely to have missing data, (dropouts, poorer attendance, et cetera) meaning that we could have underestimated the number of changes for the oldest of students in the district. Another limitation to this study is associated with how the changes were calculated. When a student exits and enters the study, it is assumed that the last ethnic classification is the most accurate and that no change in the self-classification occurred when they were missing from the study. In reality, there is a chance that a student changed the race that they identified as during that time. We could have underestimated the number of changes as well as estimated the wrong time point(s) for which the change(s) occurred for the student.

CHAPTER 4 CONCLUSION

The purpose of this study was to provide further understanding of two crucial factors of adolescent development for youth of ethnic minorities: ethnic identity formation and ethnic/racial self-classification. It is important to recall the five questions that motivated the study:

- Does the strength of ethnic identity differ among groups of adolescent students in a multicultural school environment?
- Does the strength of ethnic identity change over time for adolescents and is it stronger for a particular ethnic/racial group?
- Do youth change their ethnic/racial classification during their adolescent school years?
- When adolescent students change their ethnic/racial classification, are some groups of adolescent students more likely to do so?
- Are there any attitudinal or socio-emotional predictors of changing ethnic/racial self-classification?

With the hope that the answers to these questions could provide essential information to teachers and school administrators to promote positive learning and social outcomes of students of ethnic minorities, a summary of the major findings is provided alongside possible opportunities and implications in the school learning environment.

4.1 Ethnic Identity: Results and Discussion

The ethnic identity analysis showed that ethnic minorities displayed strong, positive feelings of belonging to their ethnic group quantified by Phinney's MEIM ethnic identity scale. The strength was particularly strong for students self-identifying as Hispanic or African American. Hispanic males had the highest ratings of ethnic identity among males in the district of study, and their ratings were statistically higher than their White and Multiracial male classmates. African American

females had the highest ratings of ethnic identity among females in the study and it was statistically higher than than females in all other ethnic groups. In addition, African American females had statistically stronger feelings of ethnic identity compared to African American males.

No statistically significant developments were found in ethnic identity among students in the district with the longitudinal analysis on the MEIM scale. However, differences among the ethnic groups were preserved longitudinally with Hispanic students having the highest scores over time. In addition, students of non-White ethnic groups were more likely to vary their ratings from semester to semester, showing signs ethnic identity search [35].

Previous research by the AACS group has found that high ratings of ethnic identity are associated with the positive outcomes in the school learning environment for ethnic minorities. Strong ethnic identity was found to be positively associated with perceptions of school climate and attitude toward school [5]. In addition, ethnic identity was found to significantly predict academic self-efficacy for students in the district [4]. Other studies have found positive associations with ethnic identity and self-esteem [39]. Fostering a school environment of openness to diversity and being more sensitive to the cultural values of students of ethnic minorities is essential to aiding students of ethnic minorities in reaching ethnic identity achievement. This, in turn, could have reciprocal, positive effects on academics and self-esteem for these students.

The low ethnic identity scores for Multiracial students in the study is an implication but also an opportunity. It may be that their confusion of their ethnic status (as found in the ethnic/racial self-classification analysis) negatively impacted their ability to reach a level ethnic identity achievement of their peers in other ethnic minorities. This should be an open awareness to teachers, administrators, and counselors in multicultural schools. Being available to these students and helping them develop pride in that their ancestral heritage derives from two or more ethnic groups could facilitate ethnic identity formation for these students [20].

As a final note on the results of the ethnic identity analysis, African American students in the district had strong ethnic identity as an ethnic group, but the strength of ethnic identity for males was statistically lower than their female African American students. Previous research on ethnic

identity development for African American males suggests that this could be due to perceived discrimination from peer classmates and/or members of the community [10] [8]. This could cause barriers and tension in the school learning environment, and school personnel should be aware of this and work to create a school environment that encourages openness to students of all cultures.

4.2 Ethnic/Racial Self-Classification: Results and Discussion

The statistical analysis found inconsistencies in self-reports of ethnicity among students in the district; over a quarter of students changed their classification of ethnicity at least once while in the study. These students were most likely to be younger, non-White, and male. Multiracial students displayed the highest odds of varying their ethnic/racial self-classification while in the study. The estimated odds of changing ethnic/racial self-classification for Multiracial students were nearly six times the odds of changing ethnic/racial self-classification for White students in the study. Longitudinal plots of estimated probabilities found that non-White students in the district had consistently high likelihoods of changing classification regardless of semester. For all semesters, males were more likely than females to change ethnic/racial classification and the gap between the genders increased over time.

Two socio-emotional or attitudinal predictors were found that explained the likelihood of changing ethnic/racial self-classification: hopefulness and feelings about school. For both scales, positive feelings of hopefulness and school were found to decrease the odds of changes in ethnic/racial self-classification for students in the district. These findings are essential to understanding the context for why students change classification and should not be ignored by school personnel. The findings for the school attitude scale are particularly interesting. Recall the description of school attachment and belonging by Johnson, Crosnoe, and Elder (p. 320) which was also cited in the Burke and Kao study (p. 752): "[It is] the extent in which students feel they are embedded in and a part of their communities" [25] [9]. The analysis found that, in particular, White females showed the most consistency in their self-reports of ethnicity. The teachers in the district are predominately White and female [32], thus providing a mirror culture for White female students but a very different situation for those changing in the district: males of ethnic minorities. Hiring teachers

of ethnic/minority groups could provide adult role models for students of ethnic minorities and a more culturally reflective environment to promote confidence in ethnic group membership.

The results raise questions about how such confusion on ethnic group membership among these students impacts academic achievement. Will the event of changing ethnic group membership instigate feelings of self-confidence and positively affect academic outcomes? Or, will the confusion of ethnic group membership provide a barrier to succeed academically? These are crucial questions going forward as schools across the country become more diverse. The results also raise implications for researchers who use ethnicity data. Education researchers, such as the AACS group, must take into account the possibility of change. The high rates of change found for all semesters in the study suggest possible implications of obtaining stable estimates of the demographic makeup of public schools.

4.3 Final Remarks

Through a statistical analysis of adolescent survey response data from a multicultural school in North Central Ohio, it is learned that the concepts of ethnic identity and ethnic/racial self-classification are extremely complex, possibly even more complex than Phinney and other prominent researchers who built the foundation of ethnic identity formation literature could have anticipated. As the demographics of the United States continue to change, these concepts are likely to become even more complex. However, it is hoped that the results of this thesis provide an additional understanding of ethnic identity development, especially in the educational setting.

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APPENDIX A

Ethnic Identity Survey Items

1. I have spent time trying to find out about my own ethnic group, such as its history, traditions, and customs.
2. I am active in organizations or social groups that include mostly members of my own ethnic group.
3. I have a clear sense of my ethnic background and what it means for me.
4. I think a lot about how my life will be affected by my ethnic group membership.
5. I am happy that I am a member of the group I belong to.
6. I am not very clear about the role of ethnicity in my life.
7. I really have not spent much time trying to learn more about the history and culture of my ethnic group.
8. I have a strong sense of belonging to my own ethnic group.
9. I understand pretty well what my ethnic group membership means to me, in terms of how I relate to my own group and other groups.
10. In order to learn more about my ethnic background, I have often talked to other people about my ethnic group.
11. I have a lot of pride in my ethnic group and its accomplishments.
12. I participate in cultural practices of my own group, such as special food, music, or customs.
13. I feel a strong attachment towards my own ethnic group.
14. I feel good about my cultural or ethnic background.

Note: items 6 and 7 are typically reverse coded before combining items into a measure of ethnic identity. For this study, items 6 and 7 were removed from the scale calculation.

Self-Esteem Survey Items

1. On the whole, I am satisfied with myself.
2. At times, I think I am no good at all.
3. I feel that I have a number of good qualities.
4. I am able to do things as well as most other people.
5. I feel I do not have much to be proud of.
6. I certainly feel useless at times.
7. I feel that I am a person of worth, or at least equal with others.
8. I wish I could have more respect for myself.
9. All in all, I sometimes think that I am a failure.
10. I take a positive attitude toward myself.

Note: Items 2, 5, 6, 8, and 9 are reverse coded before combining the items into a measure of self-esteem.

Hope Survey Items

1. I am happy with my life.
2. I have what I need in life.
3. My life is going well.
4. I have all the support from my family or friends that I need.
5. I am able to accomplish the things that I want to do in life.
6. I feel good about what's going on in my life right now.
7. I wish my life was different than it is right now.
8. I am able to do the kinds of things that other kids my age can do.
9. There are people I can count on to help me out it I need it.
10. I have more stress and pressure in my life than I can handle.

Note: Items 17 and 20 are reverse coded before combining the items into a measure of hopefulness.

School Attitude Survey Items

1. I get along well with my teachers.
2. Doing well at school is most important to me.
3. School is boring.
4. I think that I am pretty good at my schoolwork.
5. I like to fool around during class.
6. My teachers think that I am smart.
7. I'm sorry when school is over for the day.
8. I am often worried about my school work.
9. My teachers are very nice to me.
10. I don't like it when my teachers ask me questions about my schoolwork.
11. I think that getting a job would be better than coming to school.
12. I usually get very good grades.
13. I don't like other students who are noisy during class.
14. This year, our lessons are always very interesting.
15. Overall, I like school quite a lot.
16. I find a lot of my schoolwork hard to understand.
17. My class (grade level) is the nicest class in this school.
18. I want to be one of the smartest students in my school.
19. Going to school is a waste of time.
20. I work hard at my school work.

Note: items 3, 5, 8, 10, 11, 16, and 19 are reverse coded before combining the items into a measure of feelings about school.

School Climate Survey Items

1. Most of my teachers make this school a very exciting place in which to learn.
2. Most of the teachers in this school are very interested in the personal problems of students.
3. Usually, those in charge in this school are not patient with the students.
4. The teachers often seem like they are not very interested in what they are teaching.
5. Most of my teachers encourage us to use a lot of imagination in our schoolwork.
6. This is a very caring school-the teachers care about us.
7. Quite often teachers embarrass and upset students in my classes for not knowing the correct answers to questions.
8. Most of my teachers put a lot of energy and enthusiasm into their teaching.
9. In this school, our teachers encourage us to think about exciting careers.
10. The teachers don't want to get to know the students in this school.
11. I enjoy being in this school because there are not a lot of strict rules.
12. I think that I learn a lot in most of my lessons.
13. This school is full of boring students and teachers , so it is not an exciting place to be.
14. Outside of class most of the teachers are very friendly and find time to talk to students.
15. In this school, most teachers think that students are always fooling around and they punish students for everything.
16. The teachers plan lessons very well.
17. Most of my teachers encourage us to be very creative.
18. In this school, many teachers spend a lot of time helping the students with their schoolwork.
19. There are a lot of rules and regulations in this school.
20. Most of my teachers seem to be very interested in what they are teaching.
21. Teachers often try out new and exciting ways of doing things.
22. Teachers are really concerned with students' feelings.
23. In this school, teachers often make students take the blame for problems whether they did them or not.

24. Most of my teachers don't seem to prepare their lessons very well.
25. Most of my teachers give homework that helps me to understand my schoolwork.
26. Teachers in this school push students too hard.
27. The teachers in this school are not very interested in whether whether we learn or not.
28. Most of my teachers let us do things by ourselves.
29. Students in this school are friendly to new students.

Note: items 3, 4, 7, 10, 13, 15, 19, 23, 24, 26, and 27 are reverse coded before combining the items into a measure of perceptions of school climate.

APPENDIX B

Factor Analysis of 14 Survey Items

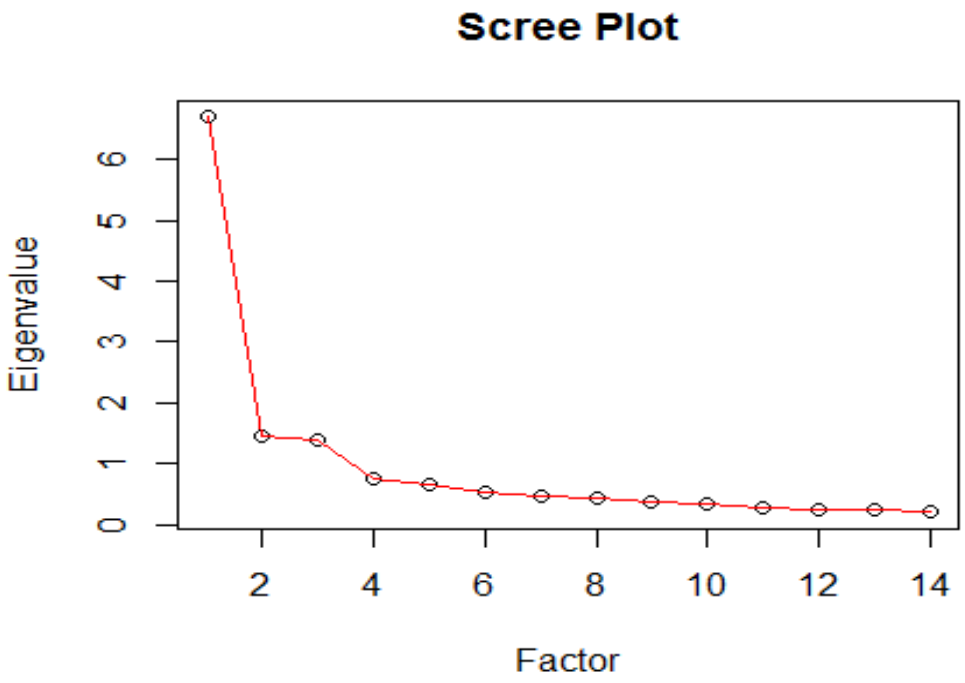

Figure 1: Scree Plot: Eigenvalues of 14 Item Polychoric Correlation Matrix by Factor

Eigenvalue	% Variance Explained	Cumulative % Variance Explained
6.698	47.8%	47.8%
1.463	10.5%	58.3%
1.382	9.9%	68.2%
0.742	5.3%	73.5%
0.650	4.6%	78.1%
0.515	3.7%	81.8%

Table 1: Eigenvalues of 14 Item Polychoric Correlation Matrix

Note: Only eigenvalues above .5 were reported in the table. A common way to select the number of factors is to choose the number of eigenvalues of the correlation matrix above 1. Using this rule, 3 factors were retained.

Factor Analysis of 12 Survey Items

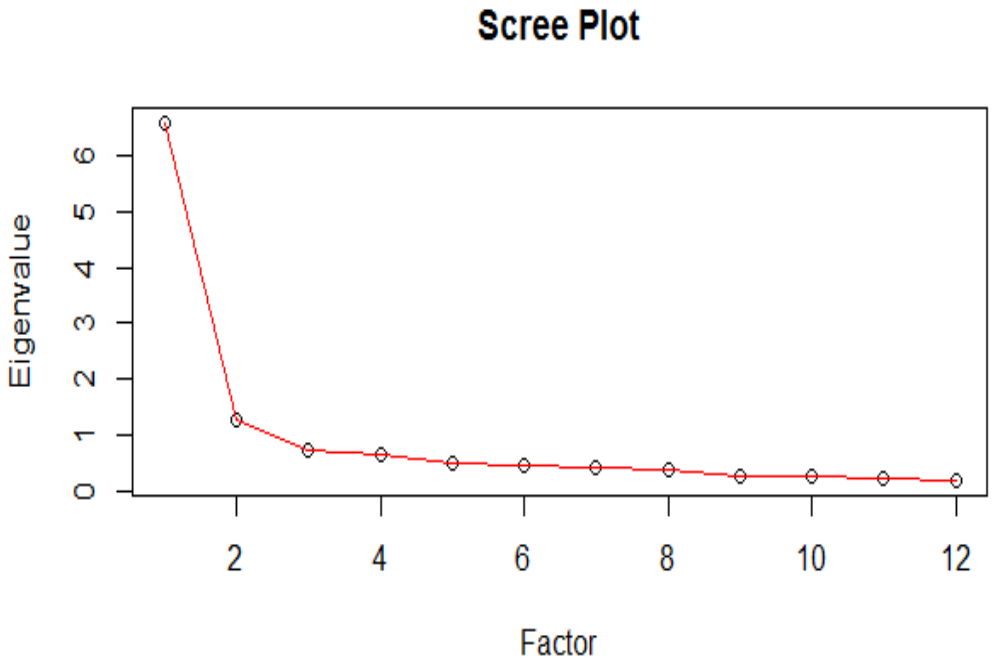

Figure 2: Scree Plot: Eigenvalues of 12 Item Polychoric Correlation Matrix by Factor

Eigenvalue	% Variance Explained	Cumulative % Variance Explained
6.577	54.8%	54.8%
1.2833	10.7%	65.5%
0.7215	6.0%	71.5%
0.652	5.4%	76.9%

Table 2: Eigenvalues of 12 Item Polychoric Correlation Matrix

Note: Only eigenvalues above .5 were reported. A common way to select the number of factors to retain is to choose the number of eigenvalues of the correlation matrix above 1. Using this rule, 2 factors were retained.

Sub-scale Analysis

The results of the factor analysis suggest that student responses to items 6 and 7 (after reverse coding) often did not correspond with responses to the other twelve items. This observation could be for two reasons: some students did not understand the questions (rating themselves similarly for items 6 and 7 as well as the other items) or some students were not paying attention to the survey section (perhaps rating themselves the same on each item). If there is evidence of the latter, these students could be removed from the analysis as their ethnic identity score would have less meaning than a student who was actually thinking about his or her answers. If students generally misunderstood the questions, it gives further evidence that items 6 and 7 should be removed when calculating the scale.

A variable was created representing the difference in scale scores between the reverse coded items 6 and 7 versus the remaining 12 items: average of items 6R and 7R - average of other 12 items. A value near zero indicates that responses to 6R and 7R correlate with responses to the other questions. In other words, students picked up on the negative phrasing and adjusted their ratings to reflect their overall self-rating of ethnic identity. However, large differences in absolute value indicate the opposite.

A histogram displaying the distribution of the difference in scales is provided in Figure 3. The majority of students had values of the difference near zero. However, it is not clear from the histogram if the counts far from zero are unusually large. To examine these counts more closely, a normal curve was fit to the histogram to compare the observed distribution for the difference in scales with what one would expect under a normal distribution. In Figure 4, the residuals of the fit are plotted against the bin mids for the histogram. The residuals for the largest difference in scales in absolute value were near or above three. There were a large number of students (at least a lot more than what one would expect with a normal distribution) that had observed score differences far way from zero in either direction.

To identify students with statistically extreme differences, a student's difference was transformed into a z-score: $\frac{diff - \bar{diff}}{s_{diff}}$. The z-score transformation translates a student's score difference

into how many standard deviations his or her difference is above or below the mean score difference. Under the assumption of normality, we expect roughly 95% of z-scores to fall within -2 and 2 or 99% of z-scores to fall within -3 and 3. Any student that has a z-score that falls outside the +/- 2 and +/- 3 fences has a statistically unusual scale difference. Thirty five students had z-scores falling outside of the fences: 16 falling more than 2 standard deviations out but less than 3 and 19 falling more than 3 standard deviations out.

The statistical software R was utilized to extract a vector of IDs, and the survey responses of these students were examined. Among the 19 students that had scale differences falling more than 3 standard deviations from the mean difference, 15 listed the same rating for each question (all 1's or 4's). While these students rated themselves the same on each of the items in the ethnic identity section, they varied their responses to items in sections before and after. This suggests that these students were paying attention to the survey but could have felt so strongly about their ethnic identity that they missed the negative phrasing of items 6 and 7, rating themselves on the extreme for each item. Survey responses of students who had z-scores that fell outside the +/- 2 fences but within the +/- 3 fences showed no general pattern. Perhaps these students just had difficulty with the phrasing of items 6 and 7 and thus, could not accurately rate their feelings of ethnic identity for these questions.

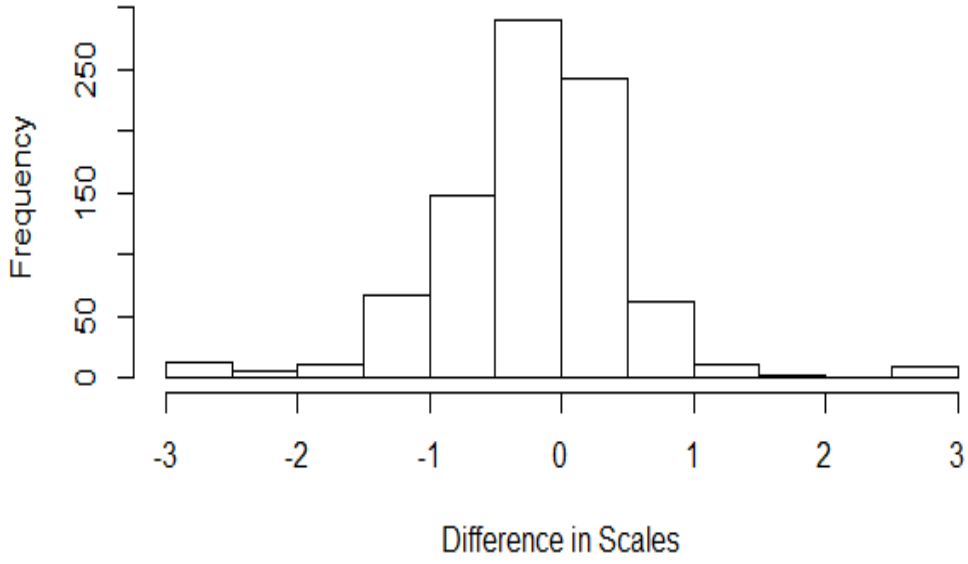

Figure 3: Histogram of Difference in Scores

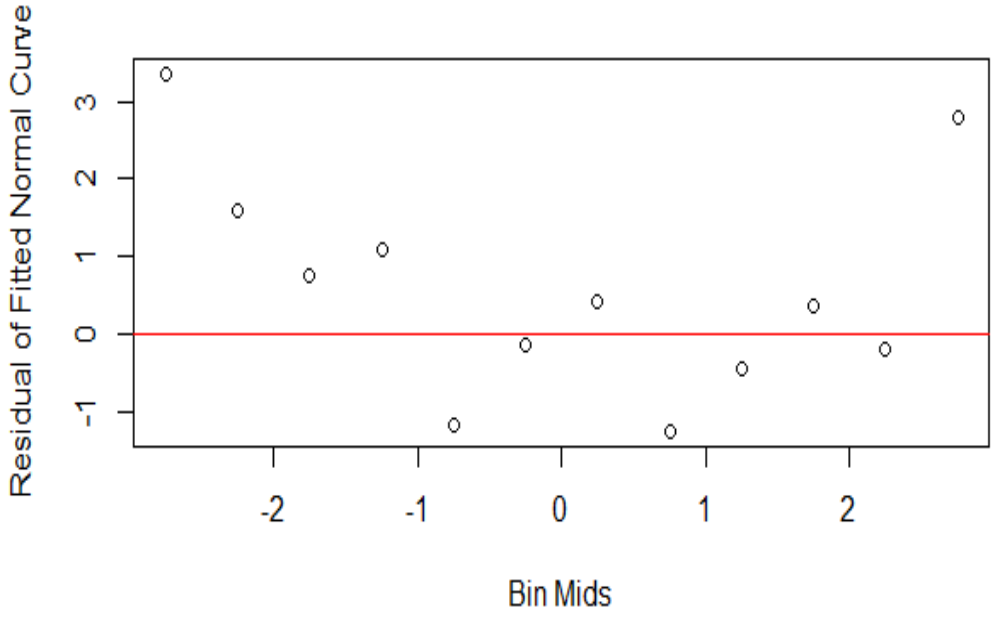

Figure 4: Residuals of Fitted Normal Curve

Analysis of Variance Results

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	7	2929.85944	418.55135	11.75	<.0001
Error	908	32348.62418	35.62624		
Corrected Total	915	35278.48362			

R-Square	Coeff Var	Root MSE	EthID_ss_W3_sum Mean
0.083049	18.57447	5.968772	32.13428

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Gender_W3	1	8.940700	8.940700	0.25	0.6165
Ethnicity_W3_REV	3	2459.310296	819.770099	23.01	<.0001
Gender_W3*Ethnicity_	3	461.608446	153.869482	4.32	0.0049

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Gender_W3	1	229.022193	229.022193	6.43	0.0114
Ethnicity_W3_REV	3	2641.784341	880.594780	24.72	<.0001
Gender_W3*Ethnicity_	3	461.608446	153.869482	4.32	0.0049

Figure 5: ANOVA Table

Post-hoc Analysis

Group	1	2	3	4	5	6	7	8
1	-	.1923	.0153	.1222	.0011	.4037	.0063	.6700
2	-	-	$<$.0001	.0009	.0184	.5976	$<$.0001	.0335
3	-	-	-	.3366	$<$.0001	$<$.0001	.5445	.0033
4	-	-	-	-	$<$.0001	.0056	.1647	.1309
5	-	-	-	-	-	.0054	$<$.0001	$<$.0001
6	-	-	-	-	-	-	$<$.0001	.1223
7	-	-	-	-	-	-	-	.0006
8	-	-	-	-	-	-	-	-

Table 3: Post-hoc P-Value Matrix

Note: To compare gender at each level of ethnicity, use α = .05. To compare ethnicity at each level of gender, use α = .05/6. The gender/ethnicity groups are the following: 1 - Black Male; 2 - Hispanic Male; 3- White Male; 4 - Multiracial Male; 5 - Black Female; 6 - Hispanic Female; 7 - White Female; 8 - Multiracial Female.

Non-parametric ANOVA Permutation Test

```
> adonis(Y~A,permutations=1000,method="euclid")

Call:
adonis(formula = Y ~ A, permutations = 1000, method = "euclid")

Permutation: free
Number of permutations: 1000

Terms added sequentially (first to last)

          Df SumsOfSqs MeanSqs F.Model      R2   Pr(>F)
A          7      2930  418.55  11.748 0.08305 0.000999 ***
Residuals 908     32349   35.63         0.91695
Total     915     35278                 1.00000
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Figure 6: Non-Parametric ANOVA Table

Repeated Measures Results

W3 ANALYSIS OF VARIANCE ON ETHNIC IDENTITY SCALE SCORE

The GLM Procedure
Repeated Measures Analysis of Variance
Tests of Hypotheses for Between Subjects Effects

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Ethnicity_W3_REV	3	2860.26678	953.42226	9.68	<.0001
Error	336	33079.92366	98.45215		

W3 ANALYSIS OF VARIANCE ON ETHNIC IDENTITY SCALE SCORE

The GLM Procedure
Repeated Measures Analysis of Variance
Univariate Tests of Hypotheses for Within Subject Effects

Source	DF	Type III SS	Mean Square	F Value	Pr > F	Adj Pr > F	
						G - G	H-F-L
time	3	29.04017	9.68006	0.55	0.6475	0.6373	0.6390
time*Ethnicity_W3_REV	9	82.03843	9.11538	0.52	0.8616	0.8525	0.8540
Error(time)	1008	17707.85054	17.56731				

Greenhouse-Geisser Epsilon	0.9436
Huynh-Feldt-Lecoutre Epsilon	0.9525

Figure 7: Repeated Measures ANOVA Table

Fitting Logistic Regression Model

Variable	Degrees of Freedom	Wald Test Statistic	P-value
Gender	1	13.11	0.00
Ethnicity	3	68.93	0.00
Grade	3	15.37	0.00
Self-Esteem Scale	1	0.23	0.63
Hope Scale	1	3.09	0.08
School Attitude Scale	1	4.98	0.03
School Climate Scale	1	2.34	0.13

Table 4: Logistic Regression Model: Flagging Test Results

The Wald p-value for the self-esteem scale was 0.63 which was greater than any traditional significance level. This variable was removed from consideration for the initial model. Gender, ethnicity, grade level, hope, school attitude, and school climate were considered as variables for an initial model.

Variable	Hope Scale	School Attitude Scale	School Climate Scale
Hope Scale	1	0.44	0.35
School Attitude Scale	-	1	0.65
School Climate Scale	-	-	1

Table 5: Correlation Matrix of Survey Scales

The correlation of the school climate and school attitude scale were reasonably high. Possible multicollinearity issues were noted. Either one of these variables could cover up the effect of the other.

Variable	Degrees of Freedom	Wald Test Statistic	P-value
Gender	1	15.13	0.00
Ethnicity	3	65.44	0.00
Grade	3	18.44	0.00
Hope Scale	1	1.86	0.17
School Attitude Scale	1	0.55	0.46
School Climate Scale	1	0.00	0.97

Table 6: Initial Logistic Regression Model: Analysis of Effects

In the presence of the demographic variables, the scales did not add additional explanation to the explanation of one or more changes in ethnic/racial self-classification. The demographic variables were the most related to the response. The question was whether one or two of the scales could add additional information to predict one or more changes in ethnic/racial self-classification.

Step	Variable Removed	AIC
1	-	690.79
2	School Climate Scale	688.79
3	School Attitude Scale	687.61
4	Hope Scale	689.24

Table 7: Logistic Regression Model: Backward Stepwise Model Selection Results

Backward stepwise selection was utilized to remove variables one at a time that added the least prediction. AIC criterion ($-2LogL + 2p$, where p = number of parameters) was referenced at each step. Removing the school climate and school attitude scales reduced AIC which indicated that those variables were to be removed. Removing the hope scale at the last step increased AIC which indicated that the hope scale added enough prediction to warrant being in the model.

Variable	Degrees of Freedom	Wald Test Statistic	P-value
Gender	1	16.31	0.00
Ethnicity	3	65.91	0.00
Grade	3	18.15	0.00
Hope Scale	1	3.63	0.06

Table 8: Refined Logistic Regression Model: Analysis of Effects

Scale	AIC	Wald P-value
Hope	687.61	0.06
School Climate	689.94	0.26
School Attitude	688.66	0.11

Table 9: Logistic Regression Model: One Scale Models with Demographic Variables

The hope scale model with the three demographic variables was the best one scale model for the study according to AIC criterion and Wald p-values.

Scales	AIC	Wald P-values
Hope and School Attitude	688.79	0.17(Hope) 0.37(School Attitude)
Hope and School Climate	689.34	0.11(Hope) 0.60(School Climate)
School Attitude and School Climate	690.65	0.26(Hope) 0.92(School Climate)

Table 10: Logistic Regression Model: Two Scale Models with Demographic Variables

All two scale models with the demographic predictor variables had a higher AIC than the refined model. The refined model with the three demographic predictor variables and the hope scale was recommended for the study.

Final Logistic Regression Model

Model Fit Statistics		
Criterion	Intercept Only	Intercept and Covariates
AIC	780.869	687.609
SC	785.445	728.797
-2 Log L	778.869	669.609

Testing Global Null Hypothesis: BETA=0			
Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	109.2597	8	<.0001
Score	106.5427	8	<.0001
Wald	91.0460	8	<.0001

Figure 8: Logistic Regression Model Fit Statistics

Analysis of Maximum Likelihood Estimates						
Parameter		DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept		1	-3.2773	0.3544	85.5391	<.0001
Gender_W1	1	1	0.8057	0.1995	16.3062	<.0001
Grade_W1	7	1	1.1319	0.3485	10.5483	0.0012
Grade_W1	8	1	1.3446	0.3464	15.0682	0.0001
Grade_W1	9	1	0.6523	0.3536	3.4031	0.0651
Ethnicity_W1	3	1	1.3424	0.3483	14.8550	0.0001
Ethnicity_W1	4	1	1.2376	0.2890	18.3391	<.0001
Ethnicity_W1	6	1	1.7526	0.2268	59.7170	<.0001
hope_std		1	-0.1883	0.0989	3.6271	0.0568

Odds Ratio Estimates			
Effect	Point Estimate	95% Wald Confidence Limits	
Gender_W1 1 vs 2	2.238	1.514	3.309
Grade_W1 7 vs 10	3.101	1.566	6.141
Grade_W1 8 vs 10	3.837	1.946	7.565
Grade_W1 9 vs 10	1.920	0.960	3.840
Ethnicity_W1 3 vs 5	3.828	1.934	7.577
Ethnicity_W1 4 vs 5	3.447	1.956	6.074
Ethnicity_W1 6 vs 5	5.769	3.699	8.999
hope_std	0.828	0.682	1.006

Figure 9: Logistic Regression Model Coefficients and Odds Ratios

Logistic Regression Model Diagnostics

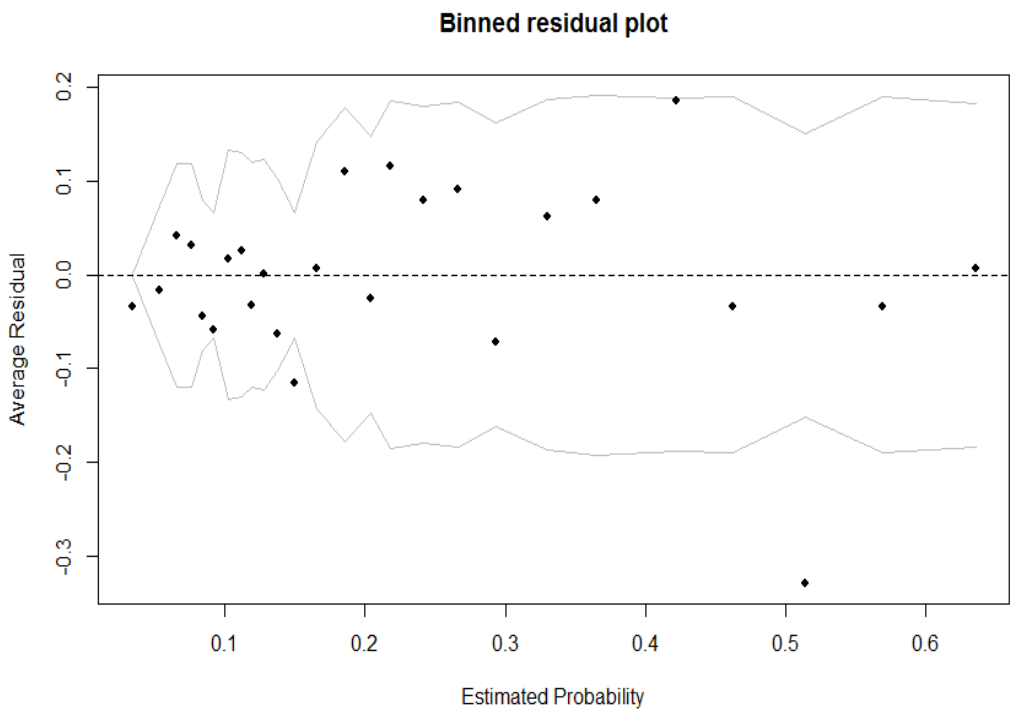

Figure 10: Logistic Regression: Binned Residual Plot

Residuals were computed for all data points using the following formula: $Y_i - logit^{-1}(X_i\beta)$. The data was partitioned into 26 bins using the $\sqrt{n}$ rule to better see patterns in the residuals [23]. A mean residual as well as a mean predicted probability was computed for each bin. The error bounds were constructed using the standard error of the predicted probability of change. The plot shows no obvious patterns in the residuals; the residuals seem to fall randomly about zero. There is one obvious outlier. The model significantly over approximated the probability of one group as shown by the extremely negative residual.

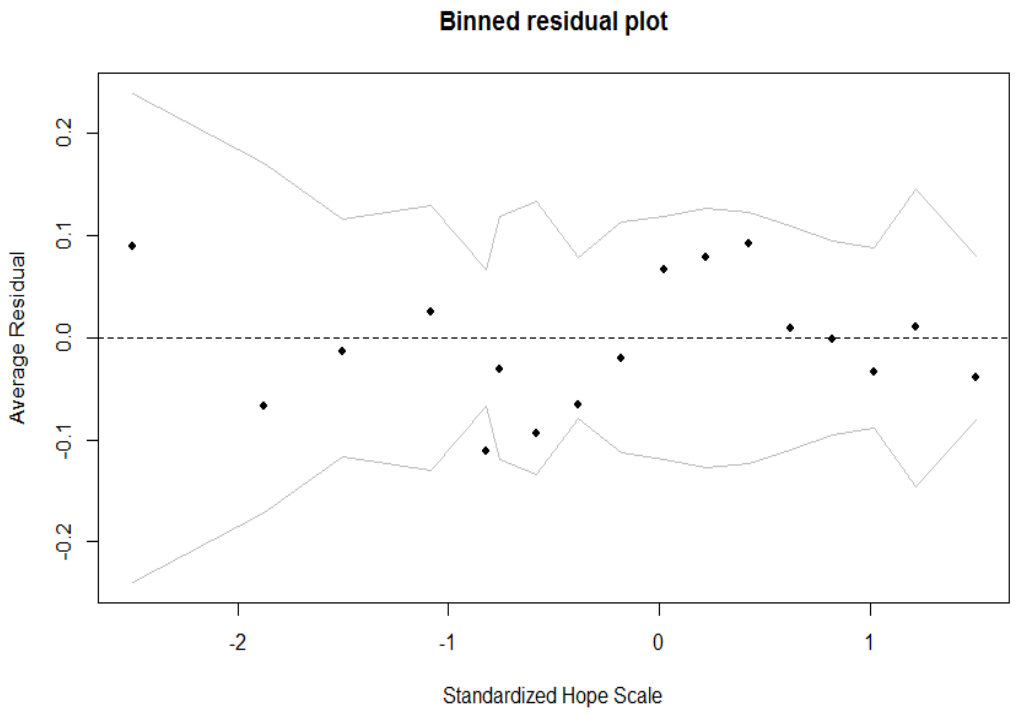

Figure 11: Logistic Regression: Binned Residual Plot with Hope Scale

A binned residual plot was also constructed for the standardized hope scale score. There were some non-random patterns in the residuals.

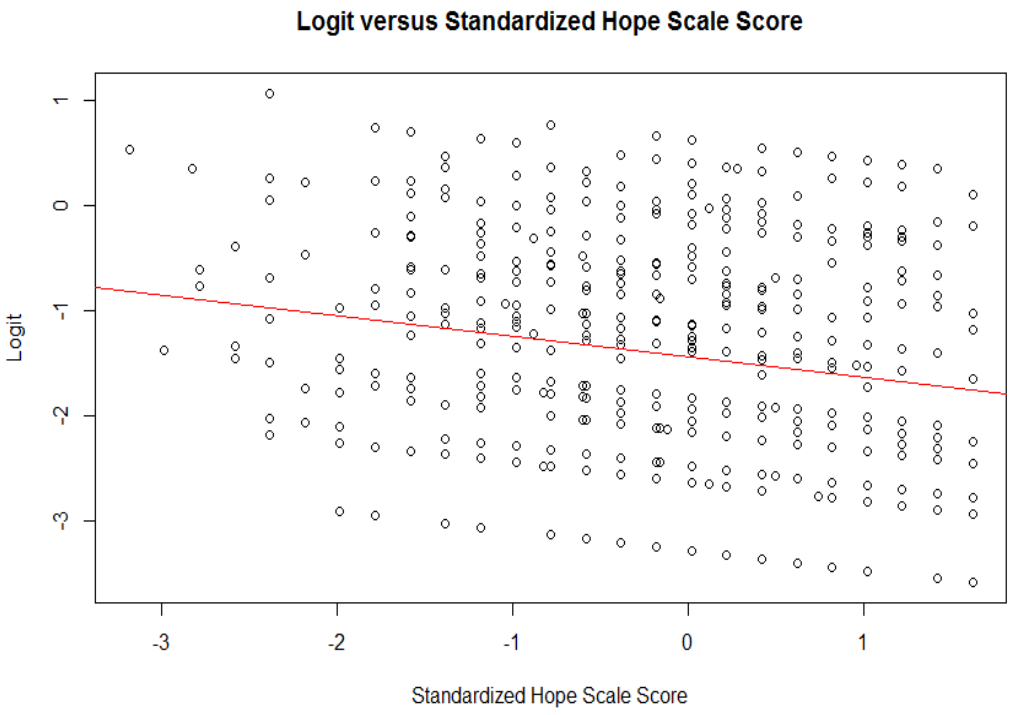

Figure 12: Plot of Logit vs. Standardized Hope Scale Score

An assumption of the logistic regression model is that the logit increases/decreases linearly as a function of the predictors. A plot of the logit versus the continuous predictor of the hope scale score shows a linear relationship ($r = -0.195$, $t = -3.52$, p-value = <0.0001).

Fitting Ordinal Logistic Regression Model

Variable	Degrees of Freedom	Wald Test Statistic	P-value
Gender	1	12.50	0.00
Ethnicity	3	67.81	0.00
Grade	3	16.05	0.00
Self-Esteem Scale	1	0.25	0.70
Hope Scale	1	3.04	0.08
School Attitude Scale	1	5.83	0.02
School Climate Scale	1	2.87	0.09

Table 11: Ordinal Logistic Regression Model: Flagging Test Results

The Wald p-value for the self-esteem scale was 0.70 which was greater than any traditional significance level. This variable was removed from consideration for the initial model. Gender, ethnicity, grade level, hope, school attitude, and school climate were considered as variables for an initial model.

Variable	Degrees of Freedom	Wald Test Statistic	P-value
Gender	1	13.15	0.00
Ethnicity	3	64.72	0.00
Grade	3	18.15	0.00
Hope Scale	1	1.10	0.29
School Attitude Scale	1	0.94	0.33
School Climate Scale	1	0.00	0.95

Table 12: Initial Ordinal Logistic Regression Model: Analysis of Effects

In the presence of the demographic variables, the scales did not add additional explanation to the explanation of one or two or more changes in ethnic/racial self-classification. The demographic variables were the most related to the response. The question was whether one or two of the scales could add additional information to predict one or two or more changes in ethnic/racial self-classification.

Step	Variable Removed	AIC
1	-	921.63
2	School Climate Scale	919.63
3	Hope Scale	918.77
4	School Attitude Scale	920.23

Table 13: Ordinal Logistic Regression Model: Backward Stepwise Model Selection Results

Backward stepwise selection was utilized to remove variables one at a time that added the least prediction. Removing the school climate and hope scales reduced AIC which indicated that those variables were to be removed. Removing the school attitude scale at the last step increased AIC which indicated that the school attitude scale added enough prediction to warrant being in the model.

Variable	Degrees of Freedom	Wald Test Statistic	P-value
Gender	1	12.33	0.00
Ethnicity	3	66.23	0.00
Grade	3	17.71	0.00
School Attitude Scale	1	3.44	0.06

Table 14: Refined Ordinal Logistic Regression Model: Analysis of Effects

Scale	AIC	Wald P-value
Hope	919.26	0.08
School Climate	920.49	0.18
School Attitude	918.77	0.06

Table 15: Ordinal Logistic Regression Model: One Scale Models with Demographic Variables

The school attitude scale model with the three demographic variables was the best one scale model for the study according to AIC criterion and Wald p-values.

Scales	AIC	Wald P-values
Hope and School Attitude	919.63	0.28(Hope) 0.20(School Attitude)
Hope and School Climate	920.58	0.17(Hope) 0.41(School Climate)
School Attitude and School Climate	920.75	0.19(School Attitude) 0.89(School Climate)

Table 16: Ordinal Logistic Regression Model: Two Scale Models with Demographic Variables

All two scale models with the demographic predictor variables had a higher AIC than the refined model. The refined model with the three demographic predictor variables and the school attitude scale was recommended for the study.

Final Ordinal Logistic Regression Model

Model Fit Statistics		
Criterion	Intercept Only	Intercept and Covariates
AIC	1009.318	918.766
SC	1018.471	964.530
-2 Log L	1005.318	898.766

Testing Global Null Hypothesis: BETA=0			
Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	106.5527	8	<.0001
Score	104.9972	8	<.0001
Wald	91.2679	8	<.0001

Figure 13: Ordinal Logistic Regression Model Fit Statistics

Analysis of Maximum Likelihood Estimates						
Parameter		DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept	2	1	-3.8571	0.3561	117.2902	<.0001
Intercept	1	1	-3.1140	0.3432	82.3491	<.0001
Gender_W1	1	1	0.6710	0.1911	12.3341	0.0004
Grade_W1	7	1	1.0820	0.3392	10.1755	0.0014
Grade_W1	8	1	1.2256	0.3397	13.0171	0.0003
Grade_W1	9	1	0.5541	0.3492	2.5183	0.1125
Ethnicity_W1	3	1	1.3371	0.3389	15.5633	<.0001
Ethnicity_W1	4	1	1.1533	0.2843	16.4543	<.0001
Ethnicity_W1	6	1	1.7138	0.2193	61.0722	<.0001
SchAtt_std		1	-0.1725	0.0929	3.4449	0.0634

Odds Ratio Estimates			
Effect	Point Estimate	95% Wald Confidence Limits	
Gender_W1 1 vs 2	1.956	1.345	2.845
Grade_W1 7 vs 10	2.951	1.518	5.736
Grade_W1 8 vs 10	3.406	1.750	6.629
Grade_W1 9 vs 10	1.740	0.878	3.451
Ethnicity_W1 3 vs 5	3.808	1.960	7.400
Ethnicity_W1 4 vs 5	3.169	1.815	5.532
Ethnicity_W1 6 vs 5	5.550	3.611	8.530
SchAtt_std	0.842	0.701	1.010

Figure 14: Ordinal Logistic Regression Model Coefficients and Odds Ratios

Ordinal Logistic Regression Model Diagnostics

Score Test for the Proportional Odds Assumption		
Chi-Square	DF	Pr > ChiSq
8.8423	8	0.3558

Figure 15: Test of Proportional Odds Assumption

The ordinal regression model assumes that the relationship between the predictor variables and the logits are the same for both logits [1]. The p-value for the test was 0.356 which was greater than any traditional significance level. There was insufficient evidence to suggest that a separate set of coefficients for each logit was needed to improve the prediction. One set of coefficients was suitable to fit the data.

The residual plots on the next two pages show a lack of fit for students with a higher probability of changing ethnic/racial classification. The model tended to over approximate the probability of change for these students. The results of the ordinal regression model should be taken with caution. Plots of the logits versus the standardized school attitude scale confirmed the assumed linear relationship between the logit and the predictor variables.

Figure 16: Ordinal Logistic Regression: Binned Residual Plot 1

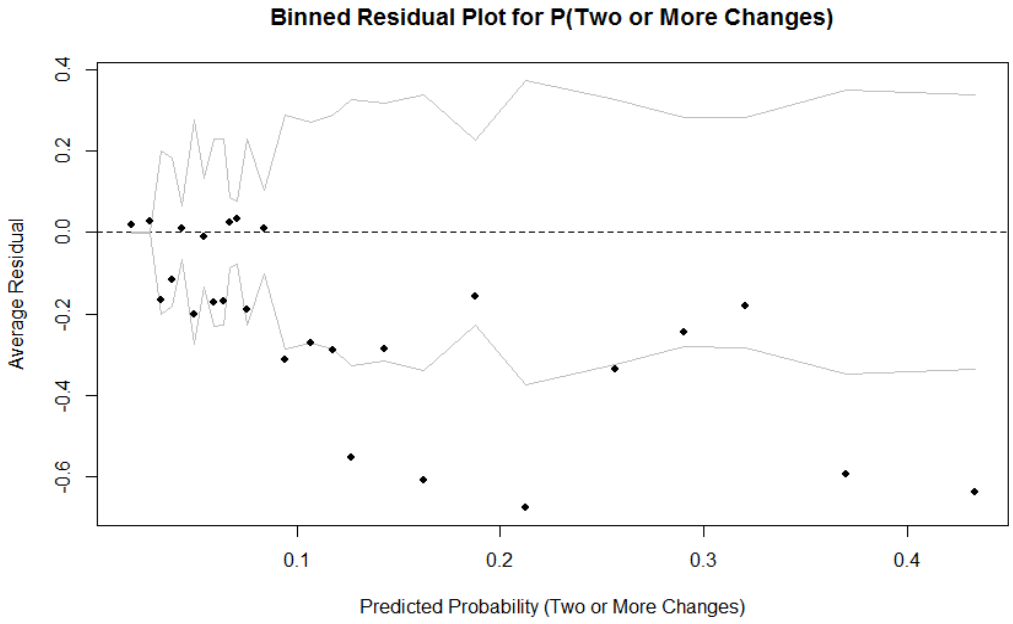

Figure 17: Ordinal Logistic Regression: Binned Residual Plot 2

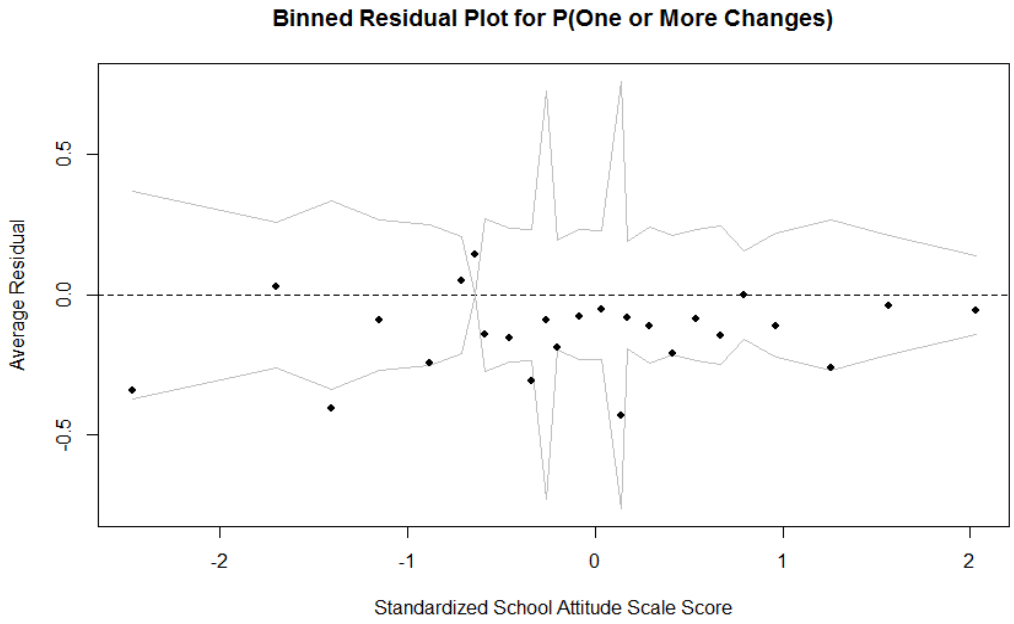

Figure 18: Ordinal Logistic Regression: Binned Residual with Scale Plot 1

Figure 19: Ordinal Logistic Regression: Binned Residual with Scale Plot 2

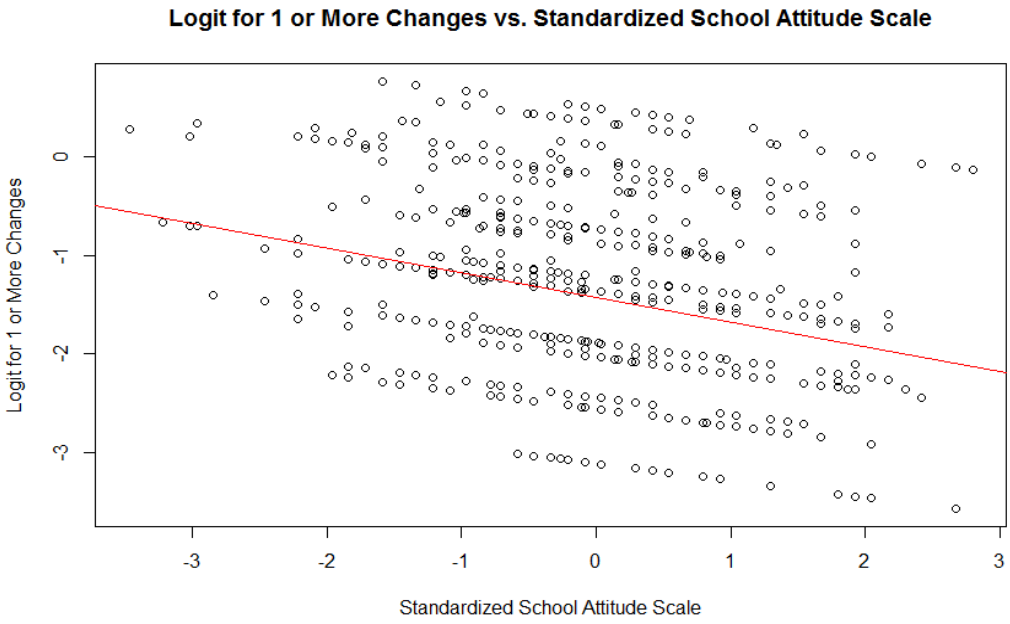

Figure 20: Plot of Logit 1 vs. Standardized School Attitude Scale Score

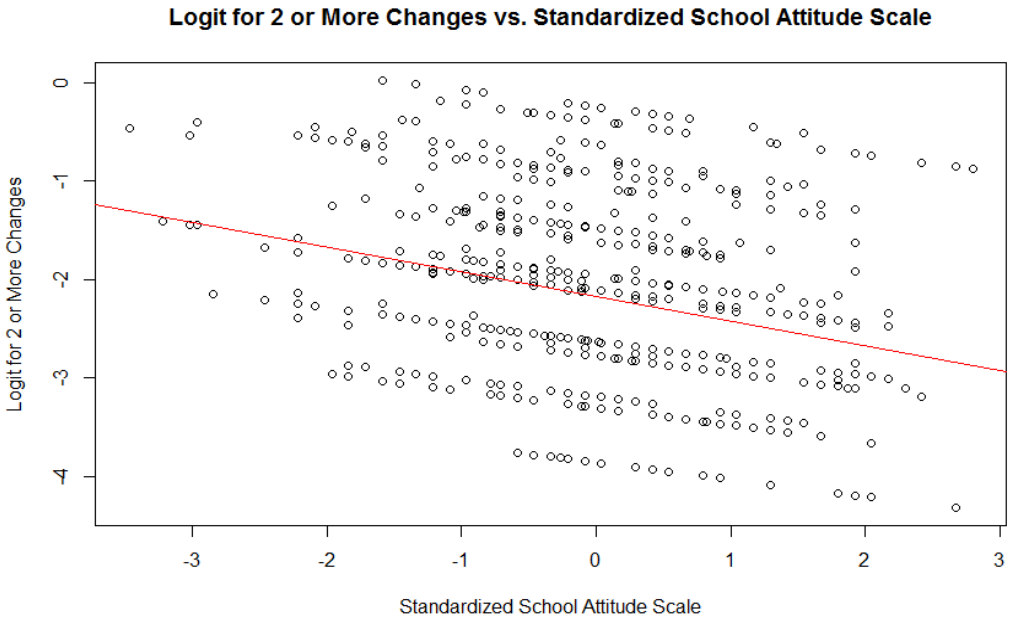

Figure 21: Plot of Logit 2 vs. Standardized School Attitude Scale Score

Estimated Probabilities and Conditional Probabilities of Change

Estimated Probability by Ethnicity

Time 2

Ethnic Group	n	p
Black	44	0.090
Hispanic	74	0.135
White	434	0.030
Multiracial	138	0.239

Table 17: Time 2: Estimated Probability of Change by Ethnicity

95% Simultaneous Confidence Intervals for the Difference in Proportion of Non-White Ethnic Group and White Ethnic Group

Multiracial and White: (0.120, 0.298)

Hispanic and White: (0.008, 0.202)

Black and White: (-0.045, 0.167)

Time 3

Ethnic Group	n	p
Black	45	0.200
Hispanic	76	0.105
White	439	0.048
Multiracial	133	0.233

Table 18: Time 3: Estimated Probability of Change by Ethnicity

95% Simultaneous Confidence Intervals for the Difference in Proportion of Non-White Ethnic Group and White Ethnic Group

Multiracial and White: (0.094, 0.276)

Hispanic and White: (-0.030, 0.145)

Black and White: (0.007, 0.297)

Time 4

Ethnic Group	n	p
Black	43	0.163
Hispanic	67	0.149
White	412	0.056
Multiracial	138	0.174

Table 19: Time 4: Estimated Probability of Change by Ethnicity

95% Simultaneous Confidence Intervals for the Difference in Proportion of Non-White Ethnic Group vs. White Ethnic Group

Multiracial and White: (0.036, 0.200)

Hispanic and White: (-0.014, 0.201)

Black and White: (-.031, 0.244)

Time 5

Ethnic Group	n	p
Black	39	0.154
Hispanic	59	0.186
White	348	0.078
Multiracial	117	0.171

Table 20: Time 5: Estimated Probability of Change by Ethnicity

95% Simultaneous Confidence Intervals for the Difference in Proportion of Non-White Ethnic Group and White Ethnic Group

Multiracial and White: (0.003, 0.184)

Hispanic and White: (-0.017, 0.235)

Black and White: (-0.066, 0.219)

Time 6

Ethnic Group	n	p
Black	33	0.121
Hispanic	52	0.135
White	315	0.048
Multiracial	96	0.177

Table 21: Time 6: Estimated Probability of Change by Ethnicity

95% Simultaneous Confidence Intervals for the Difference in Proportion of Non-White Ethnic Group vs. White Ethnic Group

Multiracial and White: (0.032, 0.227)

Hispanic and White: (-0.030, 0.204)

Black and White: (-0.065, 0.213)

Estimated Conditional Probability by Ethnicity

Time 2

Ethnic Group	n	p
Black	44	0.090
Hispanic	74	0.135
White	434	0.030
Multiracial	138	0.239

Table 22: Time 2: Estimated Conditional Probability of Change by Ethnicity

95% Simultaneous Confidence Intervals for the Difference in Proportion of Non-White Ethnic Group and White Ethnic Group

Multiracial and White: (0.120, 0.298)

Hispanic and White: (0.008, 0.202)

Black and White: (-0.045, 0.167)

Time 3

Ethnic Group	n	p
Black	41	0.171
Hispanic	66	0.076
White	427	0.035
Multiracial	104	0.144

Table 23: Time 3: Estimated Conditional Probability of Change by Ethnicity

95% Simultaneous Confidence Intervals for the Difference in Proportion of Non-White Ethnic Group and White Ethnic Group

Multiracial and White: (0.024, 0.194)

Hispanic and White: (-0.040, 0.121)

Black and White: (-0.007, 0.278)

Time 4

Ethnic Group	n	p
Black	32	0.094
Hispanic	54	0.056
White	389	0.036
Multiracial	92	0.087

Table 24: Time 4: Estimated Conditional Probability of Change by Ethnicity

95% Simultaneous Confidence Intervals for the Difference in Proportion of Non-White Ethnic Group and White Ethnic Group

Multiracial and White: (-0.023, 0.125

Hispanic and White: (-0.058, 0.098)

Black and White: (-0.068, 0.183)

Time 5

Ethnic Group	n	p
Black	27	0.111
Hispanic	44	0.114
White	316	0.028
Multiracial	70	0.057

Table 25: Time 5: Estimated Conditional Probability of Change by Ethnicity

95% Simultaneous Confidence Intervals for the Difference in Proportion of Non-White Ethnic Group and White Ethnic Group

Multiracial and White: (-0.041, 0.099)

Hispanic and White: (-0.031, 0.202)

Black and White: (-0.064, 0.229)

Time 6

Ethnic Group	n	p
Black	21	0.000
Hispanic	35	0.114
White	280	0.025
Multiracial	56	0.125

Table 26: Time 6: Estimated Conditional Probability of Change by Ethnicity

95% Simultaneous Confidence Intervals for the Difference in Proportion of Non-White Ethnic Group vs. White Ethnic Group

Multiracial and White: (-0.008, 0.208)

Hispanic and White: (-0.041, 0.220)

Black and White: (-0.047, -0.003)

Estimated Probability by Gender

Time 2

Gender	n	p
Male	336	0.095
Female	350	0.080

Table 27: Time 2: Estimated Probability of Change by Gender

95% Confidence Interval for the Difference in Proportion of Change for Males versus Females: (-0.027, 0.058)

Time 3

Gender	n	p
Male	347	0.115
Female	342	0.085

Table 28: Time 3: Estimated Probability of Change by Gender

95% Confidence Interval for the Difference in Proportion of Change for Males versus Females: (-0.014, 0.075)

Time 4

Gender	n	p
Male	318	0.126
Female	338	0.071

Table 29: Time 4: Estimated Probability of Change by Gender

95% Confidence Interval for the Difference in Proportion of Change for Males versus Females: (0.009, 0.100)

Time 5

Gender	n	p
Male	276	0.152
Female	284	0.077

Table 30: Time 5: Estimated Probability of Change by Gender

95% Confidence Interval for the Difference in Proportion of Change for Males versus Females: (0.022, 0.127)

Time 6

Gender	n	p
Male	236	0.127
Female	257	0.051

Table 31: Time 6: Estimated Probability of Change by Gender

95% Confidence Interval for the Difference in Proportion of Change for Males versus Females: (0.026, 0.127)

Estimated Conditional Probability by Gender

Time 2

Gender	n	p
Male	336	0.095
Female	350	0.080

Table 32: Time 2: Estimated Conditional Probability of Change by Gender

95% Confidence Interval for the Difference in Proportion of Change for Males versus Females: (-0.027, 0.058)

Time 3

Gender	n	p
Male	317	0.079
Female	317	0.054

Table 33: Time 3: Estimated Conditional Probability of Change by Gender

95% Confidence Interval for the Difference in Proportion of Change for Males versus Females: (-0.013, 0.064)

Time 4

Gender	n	p
Male	267	0.071
Female	296	0.030

Table 34: Time 4: Estimated Conditional Probability of Change by Gender

95% Confidence Interval for the Difference in Proportion of Change for Males versus Females: (0.004, 0.077)

Time 5

Gender	n	p
Male	211	0.076
Female	243	0.021

Table 35: Time 5: Estimated Conditional Probability of Change by Gender

95% Confidence Interval for the Difference in Proportion of Change for Males versus Females: (0.015, 0.095)

Time 6

Gender	n	p
Male	173	0.075
Female	216	0.023

Table 36: Time 6: Estimated Conditional Probability of Change by Gender

95% Confidence Interval for the Difference in Proportion of Change for Males versus Females: (0.008, 0.096)