A cross-cultural comparison of predictors of achievement amongst Caribbean students: Attitudes and Behaviors that may explain the achievement gap between girls and boys in the English-speaking Caribbean

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Dedication

This dissertation is dedicated to my English-speaking Caribbean community, and to the West Indian region at large. As a West Indian, this marks the commencement of my work in education evaluation and education research for this region. It is my intention to assist in the advancement of research and evaluation in the Caribbean community; to add to the body of knowledge surrounding factors affecting K-12 academic attainment and achievement there; and thereby make an overall contribution to the quality of education we offer our students.

Abstract

Presently in the English-speaking Caribbean, boys' underachievement at the K-12 level is a topic of great concern. Qualitative studies focusing on boys' underachievement have raised the question as to whether this issue is situational and due to short-comings in Caribbean education systems or whether it is actually endemic to Caribbean culture. Quantitative studies addressing these cultural attitudes and behaviors have been limited; therefore this study sought to address that gap and provide quantitative evidence that might explain the girl advantage amongst Caribbean students. This study utilized the Longitudinal Study of Young People in England database which contains a nationally representative sample of English youth that began in 2004 when the young people were about age 14 and in the 9th grade. This database was chosen because it contained a sample of students of Caribbean descent and it had also collected information regarding attitudinal and behavioral variables of interest that have been highlighted in Caribbean studies. In particular, by using data outside the Caribbean, this study lent itself to addressing the question of whether Caribbean boys' underachievement is situational or cultural. First, Caribbean students were compared to those from other ethnic groups on nine attitudes and behaviors of interest. Second, evidence for a girl advantage between boys and girls of Caribbean descent in Math, English and Science at the 6th and 9th grade levels was also explored. Third, the relationship between school type and the girl advantage was examined. Fourth, interaction terms between gender and attitudes/behaviors were examined to determine whether any were important in explaining the Caribbean girl advantage. Finally, it was determined whether attitudes and

behaviors were still important even after controlling for the school environment. This study employed confirmatory analyses, independent samples *t*-tests, growth curve analyses, hierarchical linear model analyses, and multiple regression when appropriate to address the questions understudy. The results demonstrated that Caribbean students generally displayed less positive attitude towards school, had more risky behavior, and had lower academic self-concept, but had parents who perceived themselves has being more involved with their child's school life. Secondly, Caribbean girls displayed an academic advantage over their male counterparts in at least 2 out of 3 subject areas at both time points. Third, no mixed-gender school appeared to attenuate the girl advantage. Fourth, by modeling certain demographic and attitudinal/behavioral variables, the Caribbean girl advantage at Key Stage 3 was accounted for in Math and Science but not English. Lastly, the importance of certain attitudes and behaviors in predicting achievement remained robust even after controlling for school environment. Overall, these results demonstrated that the Caribbean girl advantage is perhaps innate to Caribbean culture. Thus, Caribbean researchers ought to make headways in developing psychological and psycho-social instruments that can measure constructs that may perhaps explain this advantage.

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CHAPTER I. INTRODUCTION

Problem

In the English-speaking Caribbean, there is a heightened concern about the underachievement of boys across all grade levels and across almost every subject area. The achievement gap between the sexes in the STEM areas at the international level has historically disfavored girls, therefore the fact Caribbean boys tend to underachieve, and even in the STEM areas, has recently provoked much debate and research in this region. It is important then to examine and uncover reasons why boys are underperforming, not only because this trend is atypical, but because the English-speaking Caribbean has adopted the Education For All initiative established by the United Nations which advocates ***equity for all***.

The English-speaking Caribbean is a conglomerate of developing nations with limited budgets and priorities that often does not allow for costly and extensive research; however, this region boasts of relatively stable governments, inter-country alliances, and a general acknowledgement that quality education is necessary for sustainable development and progress. Therefore, if this region's education systems' render institutional disservice to boys, this ought to be addressed and remedied for the general progress of these nations. This remediation calls for rigorous research and evaluation of education systems to identify whether or not this form of institutional disservice exists, and if so, to recommend possible solutions.

Institutional disservice has at its root certain cultural, attitudinal, and discriminatory beliefs that underpin it. Accordingly, boys' underachievement in the English-speaking Caribbean may be due to certain cultural, attitudinal, and discriminatory beliefs that put boys at a disadvantage. Caribbean research then must play a large role in uncovering potential social, economical, and psychological factors that may be the root of this problem. To begin addressing this matter, it is possible to take direction from other nations, as research literature from the United States and Britain suggest various factors that may be examined to explain the achievement gap between the

sexes. Furthermore, there is a large Caribbean immigrant population in England, and it is possible to compare Caribbean students there to other ethnic groups in an attempt to uncover idiosyncrasies specific to Caribbean students. An inter-comparison of Caribbean students with other groups and an intra-comparison of beliefs and attitudes held amongst males and females of Caribbean descent would help elucidate which cultural influences contribute to Caribbean boys' disadvantage.

An extensive literature review of education research and education evaluation studies conducted in the Caribbean allowed the identification of possible factors that may explain the achievement gap between boys and girls in the English-speaking Caribbean. The goal then of this study was to examine the role these factors play in the academic achievement of Caribbean students residing outside the region in an attempt to determine whether these factors persist despite location. An external database, namely the Longitudinal Study of Young People in England database allowed ethnic comparisons to take place in an attempt to identify factors that might have been uniquely Caribbean. This database was chosen because many English-speaking Caribbean islanders migrate to England due to current or past colonization relations with UK.

Research Questions

The research questions leading this study were:-

1. How do students of Caribbean descent compare to students of other ethnic groups on identified factors related to academic achievement?
2. Is the achievement gap between boys and girls prominent amongst students of Caribbean descent who reside outside of the Caribbean? If so, how does this gap compare to the gap between girls and boys of other ethnicities?
3. Is the achievement gap between boys and girls of Caribbean descent moderated by any attitudinal or belief factors related to academic achievement?
4. What types of schools, if any, ameliorate the achievement gap between boys and girls of Caribbean descent?

5. When controlling for school environment, are attitudinal and belief factors still important for predicting the achievement gap between boys and girls of Caribbean descent?

Limitations

Sample size and non-response. Perhaps the most important limitation to this study was the sample size for Caribbean students. There were only 596 Caribbean students in the LSYPE database, but this was not surprising seeing that it was intended to be a nationally representative sample. In fact, sampling procedures had oversampled ethnic groups to ensure that enough of these individuals were included in the study. Wave and panel weights were provided to be used in statistical analyses for precision of estimations. Following the limitation of sample size, individual non-response was also an issue with ethnic minority groups experiencing the most drop-out. By Wave 3, the sample size of Caribbean students (and other ethnic minority groups) was reduced to almost half of the initial number, therefore an ethnic boost occurred at Wave 4. This restricted this dissertation to including data from Waves 1 through 3 only, as the proceeding Waves represented different students.

Immigration status. Secondly, it was not determined as to whether the Caribbean students included in this study were of first, second, or third generation immigrants. Immigration status might have a powerful effect on behaviors and attitudes related to achievement, and it is possible that first generation Caribbean students have different attitudes and behaviors compared to second or third generation Caribbean students.

Caribbean country. Lastly, for this study to be generalizable to English-speaking Caribbean islanders it would be necessary to prove that all of these 596 students immigrated from English-speaking Caribbean countries. Note that ethnic identity in the LSYPE database was self-reported. To determine the extent to which these individuals were actually from the English-speaking Caribbean, the variable for home language was explored. Parents were asked to indicate which language, other than English, was the

main language spoken at home. Of the 596 students, 20 of them have missing data, and 16 of these parents reported a second first language other than what is spoken in the Caribbean. That is, 16 of them reported some language other than French or Spanish that is spoken at home. Therefore, it is questionable as to whether 36 of the 596 have both parents originating from the Caribbean. It is possible that these 16 individuals who report a non-Caribbean language in the home have parents whose current partners are not their biological parents though this information is difficult to ascertain. Nevertheless, it does appear as though of the 596 students, 560 of them are of English-speaking Caribbean descent.

CHAPTER II: REVIEW OF THE LITERATURE

Education Research and Education Evaluation Inside the Eastern Caribbean: A Clearer Picture of what contributes to K-12 academic attainment and achievement

Background

Education research in the English-speaking Caribbean is now beginning to make its mark as evidenced by the recently established Journal of Eastern Caribbean studies (JECS). This journal is regionally-based, and as of 1997 has become an official peer-review journal published by the University of the West Indies. One of the goals of JECS is to link the academic terrains of the Eastern Caribbean, the Commonwealth Caribbean, and other developing countries in the Americas, though it gives more precedence to research conducted in the Organization of Eastern Caribbean States (OECS) countries. Other evidence of education research in the English-speaking Caribbean includes research centers at institutions of higher education located there, most notably at the University of the West Indies, the most prominent university of the English-speaking Caribbean.

Education research in the region as a whole has only recently begun to make major strides partly due to the fact that the Caribbean is comprised of a dispersion of developing countries that are in relatively early stages of establishing national identities and forming alliances with their neighboring regions. The research that has been done has mostly taken place in Jamaica, Barbados, and Trinidad & Tobago, primarily because these are the countries where the University of the West Indies has located its three major campuses. In total, there are twenty five island countries or dependencies that represent the English-speaking Caribbean; therefore there is much room for future educational research in these territories.

Likewise, formal evaluation of educational practices is also becoming more widespread inside the Caribbean with the three leading organizations conducting evaluations being the University of the West Indies, the World Bank, and UNESCO. The

Education Evaluation Centre at the University of the West Indies was established in 2002, and a face-value appraisal of the reports suggests that the evaluands tend to be of a more local nature, whereas the World Bank and UNESCO seek to present a more regional picture of the state of education in the Caribbean. It is important to note the evaluation reports at this Education Evaluation Center were not available despite attempts to contact personnel, therefore an examination of these reports was not possible. With that being said, the reader should also note that many of the World Bank and UNESCO evaluations over the past 20 years have been centered on the goals of the *Framework for Action to Meet Basic Learning Needs* that were established at the United Nations World Conference in Jomtien, Thailand in 1990 (Jules & Panneflek, 2000) . At this conference, the member states agreed to universalize primary education and massively reduce illiteracy before the end of that decade. From this meeting, the member states created the International Consultative Forum on Education for All initiative (EFA), and in 2000 this forum began an on-going assessment of the EFA initiative in the Caribbean to determine what was accomplished between 1990 and 2000. This forum continues its on-going assessment of the EFA initiative to present day.

Purpose of Literature Review

This literature review explores current education research and evaluation practices inside the English-speaking Caribbean in an attempt to highlight findings regarding predictors of academic achievement, to determine the region's focus as it pertains to what is being evaluated, to pinpoint areas where the findings from research on academic achievement and evaluation appear to inform each other, and finally to determine whether any methodologies and approaches appeared necessary to fully address the research or evaluation question, but was not implemented. These four goals then would allow me to summarize what is known, but more importantly, to suggest areas for future research.

This literature review is divided into three sections. The first section presents education research in the English-speaking Caribbean that pertains to predictors of academic achievement over the past 15 years. The second section presents evaluations conducted in the Eastern Caribbean that examined the progress of education reform in this region. The third section presents suggestions for future research and evaluation approaches for the Eastern-speaking Caribbean.

Section I: Predictors of Academic Achievement

There is limited research on factors related to K-12 academic achievement in the Caribbean. Most Caribbean research in education has focused on school types, teacher qualification, and environment-based explanations to explain academic achievement, and there has been less focus on classroom-level issues such as students' perceptions and teacher pedagogical approach (Griffith, 1999; Layne, Jules, Kutnick, & Layne, 2008). Notwithstanding, many of the K-12 education systems in the English-speaking Caribbean share similar features such as comparable grade levels, common national examinations, centralized curricula, tracking/ability-grouping, single sex and coeducation settings, and multi-grade classrooms, therefore aggregation of findings depending on the construct (for example, multi-grade classrooms) for the purposes of conducting meta-analyses may be feasible.

The first goal of Section I was to present the findings of published studies over the past fifteen years that examined some factor related to K-12 academic achievement in the English-speaking Caribbean. Knowledge of these important predictors/factors would inform policy-makers on the necessary actions needed to improve these K-12 public systems and assist in the establishment of high quality education region-wide. Academic attainment in the English-speaking Caribbean is an important predictor of individual-level economic viability and country-level national competency (Blom & Hobbs, 2008); therefore knowledge of these predictors is important to the sustainability of these developing countries.

Research in the United States can classify personal factors related to K-12 achievement into five main domains; *cognitive, affective, psychosocial, social,* and *psychological* (Eggen & Kauchak, 2007). Examples of *cognitive* factors are intelligence and goal setting; examples of *affective* factors are attitude and motivation; examples of *psychosocial* factors are identity and self-concept; examples of *social* factors are socio-economic status (SES) and ethnicity; and finally, examples of *psychological* factors are resilience and learned helplessness. Thus, the second goal of Section I was to classify the studies into one of the five domains and examine whether there was a bias towards any particular area. A bias towards any of the five domains would highlight possible gaps in current research and suggest direction for future research. Finally, the third goal of Section I was to classify the research in terms of methodology and determine whether there seemed to be a balance between quantitative and qualitative approaches.

Within the lines of these three goals, the following research questions for Section I of this literature review were postulated:

1. What are important predictors of achievement in the mainstream schools of the English speaking Caribbean?
2. What domains of factors/predictors are most researched in the English-speaking Caribbean?
3. Has there been a balance between quantitative and qualitative methodologies and approaches in educational research over the past 15 years in the English-speaking Caribbean?

With the assistance of the search engines Google, Google Scholar, and MNCAT library access, using various combinations of certain key words (academic achievement plus K-12 plus Caribbean, West Indies, and specific West Indian countries) there were approximately 45 cited educational studies in the English-speaking Caribbean that were directly related to academic achievement and a relevant factor under study. Many of these citations were found in an annotated bibliography of research done in the Caribbean during the years 1990-1999, and the purpose of this bibliography was to centralize the data in an effort to promote collaboration and establish a knowledge-base of Caribbean research in education (Quamina-Aiyejina, 2000). Of those cited, only two-thirds were

accessible as most of the research was circulated in campus journals or libraries only. Hence, this paper presents the work that was accessible and consequentially, any conclusions drawn are more restricted.

Over the past fifteen years, research related to academic achievement in the English-speaking Caribbean explored factors classifiable in four of the five domains for predictors; these were *social, psychosocial, cognitive,* and *affective*. Notably, the domain for psychological factors was not represented. However, an interesting finding from this literature search revealed a new domain; that is, "health related factors". Health related factors such as anemia and parasitic infections are common in the Caribbean, therefore students with these conditions are not viewed as *different* or "special needs" despite the fact that medical complications can result in prolonged absenteeism.

In the English-speaking Caribbean, there is a heightened concern about the underachievement of boys across all grade levels and across almost every subject area. The achievement gap between the sexes in Science Technology Engineering and Math (STEM) content areas at the international level has typically disfavored girls; therefore it is a quandary as to why the reverse has taken place in the Caribbean. Moreover, due to the fact that past international research addressing the achievement gap between the sexes in math and science has mainly focused on raising girls achievement, the Caribbean has limited resources to draw on to address this matter. It is not surprising then, that more in depth research has fallen into the *Social* domain which captures the achievement gap between the sexes and the *Psychosocial* domain which captures issues related to gender identity. It should be noted that due to the perplexity of male underachievement, almost every study had some mention of the underperformance of boys even when the achievement gap was not a main focus of the research.

Social Domain. There were twelve studies that investigated factors related to social matters pertaining to academic achievement. These factors included the achievement gap between the sexes/genders, poverty, violence, peer acceptance, school quality & peer quality, and the cultural mediation of learning through language. Jimerson, Dubrow, and Wagstaff (2009) postulated that social factors may play important

roles in learning behaviors of Caribbean children because the low mobility opportunities of island-living and the stability of communities make factors such as peer influence, stigmatization, community expectations, and cultural values more pressing in the lives of students compared to more industrialized countries. Of these ten studies, three focused on the achievement gap between the sexes in Trinidad and Tobago, Jamaica, and Barbados (Evans, 1999; Kutnick, 1999; Lisle, Smith, & Jules, 2005). Previous research cited by these authors demonstrated that differences between the sexes had patterns that were predicted by certain classroom, organizational, and socio-cultural factors as well as age, ability, and grade levels. Other research they cited explained male underachievement due to the matriarchal role of Caribbean women in the family and the marginalization of men. These arguments are succinctly summarized in Figueroa (2000).

To further explicate the causes of male underachievement and not merely attribute it to socialization issues, Kutnick (2000 & 1999) adopted a mixed method approach to investigate the gender gap in primary and secondary schools in Barbados. Through quantitative analyses of data collected, as well as conducting case studies at two disparate secondary schools, he found that factors affecting school achievement included the type of school attended, pre-school attendance, parental occupation, presence of father in home, help with homework, and school culture. This confirmed many of the findings in Kutnick, Jules, and Layne (1997) which was a comprehensive study of the relationship between gender and achievement in Trinidad, St Vincent, and Barbadian schools. The findings from Kutnick (1999) study, however, suggested that parental occupation may be more influential than gender.

Likewise, Lisle et al (2005) also investigated gender differences in Trinidad and Tobago, but used primary level data only. Data included scores from standardized national exams students took at three different grade levels throughout primary school finishing with the secondary entrance exams (also known as common entrance exam (CEE 11+), or grade six achievement test GSAT in Jamaica) which determined what type of secondary institution students gained access to. Lisle et. al. used primary level data in order to avoid selection bias, because public secondary schools in Trinidad and Tobago were stratified according to the type of student assigned to the school. Through

quantitative analyses it was confirmed that, on average, females did have a significant advantage over males across all outcome measures (though the difference was not practical), however the size of and direction of this advantage sometimes varied when accounting for other factors such as academic subject tested, location of school, age group, ability level, and gender-organization of school. Similarly to Kutnick (1999), there was no significant difference between the sexes of higher achieving students.

Evans (1999) also utilized a mixed methods approach and through survey data and ethnographic research of secondary schools in Jamaica, she examined other factors that may have contributed to gender differences. The ethnographic results demonstrated that girls were more consistent in paying attention and participating; boys had more negative school experiences, e.g. harsher corporal discipline, being insulted, and being negatively compared to girls; and that more boys felt resentful towards teachers and schooling. Significant survey results revealed that compared to girls, boys had a higher rate of absenteeism; boys tended to spend less time reading on the weekends; more boys had part-time jobs or were required to contribute to the family income; more boys agreed that they didn't need to be good at school to be successful in life; and more boys agreed that being rich was more important than being educated. (It is important to point out, however, that the percentages of girls and boys agreeing to the last two items were low demonstrating that the majority of students highly valued education and thought it was very important to future success). Finally, perhaps the most important finding relating to social factors was that 40% of the boys thought that to be popular and respected, they couldn't be perceived as serious about their schoolwork.

Aside from the gender gap, other social factors studied were poverty, violence, peer acceptance, school quality & peer quality, and the cultural mediation of learning through language. Smith and Ashiabi (2007) conducted a literature review on the effects of poverty on Jamaican child outcomes. These authors summarized that Jamaican children from disadvantaged backgrounds lacked access to good quality schools, were more likely to have developmental disorders, maladaptive behavior, and psychiatric disturbances. In addition, through model development based on their literature review,

these authors posited that cognitive/academic outcomes and emotional/behavioral outcomes had a reciprocal relationship.

In addition to poverty, violence also plays a major role in the lives of many Caribbean children and it may have a significant relationship with academic achievement (Baker-Henningham, Meeks-Gardner, Chang, &Walker 2009). Baker-Henningham et al. employed a mixed methods approach to examine the relationship between urban Jamaican children's experiences with violence and their academic achievement. Twenty nine schools were randomly selected, and from these schools, fifth grade classes were selected to investigate top, middle, and bottom achievers. These researchers found a dose-response relationship between exposure to violence and academic achievement, with children with more exposures having poorer scores.

In a different vein, Durbrow, Wagstaff, and Turk (2002), as part of a longitudinal study investigating societal changes and outcomes, examined the relationship between academic performance and peer preference in primary school-aged children in a rural village of St Vincent. Through the use of peer nomination procedures, academic scores, and teacher-ratings, quantitative analyses demonstrated that children with higher abstract reasoning and fewer learning problems were more popular, had fewer conduct problems, and had higher academic scores. There was no significant difference between the sexes, different age groups, or interactions with sex and age groups. The path analysis results also confirmed their hypothesis that academic scores mediated the relationship between peer preference and the three constructs of age, abstract reasoning, and learning problems. Further findings from a follow-up study conducted by Jimerson, Durbrow, and Wagstaff (2009) were consistent with the results above. These authors postulated that a possible explanation for these results was that, in the Caribbean, low achieving students tended to be stigmatized and avoided as playmates whereas higher ranking students were more valued, and that this form of socialization was possibly influenced by the tracking & ranking system characteristic of Caribbean schools.

To control for the influence of the tracking & ranking system of Caribbean schools, Jackson (2009) investigated the relationship between peer quality and academic performance at a range of secondary schools in Trinidad and Tobago by using

longitudinal examination data. Jackson used mean scores from national datasets over a five year period as a proxy for peer quality. That is, since students are assigned to secondary schools based on their standardized score in $5^{th}/6^{th}$ grades, the average score of those students assigned to a particular school was a proxy for peer quality. He found that increases of within school peer quality during an individual's secondary school experience only had an effect on academic achievement at high achieving schools. His results suggested that improving school resources in order to raise academic achievement may not have the desired affect if the peer quality (that is, relative ranking) of a school is low. Thus, peer deposition towards school work might be an important social factor related to academic achievement in the English-speaking Caribbean.

Another distinguishing characteristic of the Caribbean school system is the institutionalization of multi-grade schools in rural areas. Multi-grade schooling is a type of school organization in which classrooms are comprised of at least two grade levels of students (e.g. first, second, and third graders in one classroom), whereas mono-grade schooling represent the typical school where there is only one grade level per classroom unit (e.g. second grade). To examine the effects of multi-grade schools on primary school students' achievement, Berry (2001) employed an ex post facto, quasi-experimental design using longitudinal data of reading test scores obtained over a four year period. While his results were tentative, they suggested that multi-grade schools might lessen the achievement gap between high performing and low performing students.

Lastly, Bryan (1997, 1996) and Sylva and Blatchford (1995) conducted qualitative case studies investigating the role of Jamaican Creole and English language in teaching strategies in Jamaican primary schools. Bryan found that the use of Creole could be used as a cultural learning tool to assist students in grasping concepts because Creole was the language accessible to all Jamaican students. Similarly, Sylva and Blatchford found that there was a big disconnect between the home lives and school lives of poor marginalized students, therefore they postulated that the use of Creole in the primary school classrooms would greatly assist these type of students in their understanding and acclimatization of school culture, academic skills, and teacher

expectations. Bryan did caution though that the use of Creole as default might hinder the acquisition of literacy in the English language.

Overall, the research exploring academic achievement in relation to social factors demonstrated that a variety of social factors were examined over the last fifteen years and many of them detailed some aspect of the achievement gap between the sexes. Collectively, the studies employed a mixture of qualitative and quantitative methodologies and used a combination of locally gathered data as well as large-scale national data which represented a good balance towards a more holistic approach to research. Furthermore, these studies in the social domain reveal other important intricacies of Caribbean schooling such as the tracking & ranking system and the expectations such a system possibly generates.

The tracking & ranking system is an important feature of schooling in the Caribbean. This system begins when the student has gained access to a secondary school through passing a compulsory secondary entrance exam. This entrance exam is taken by 11 year olds (regardless of the grade they are in), and if they are successful, they advance to secondary schooling. If they are not successful, they are allowed to take the exam again the following year. Students are assigned to secondary schools based on their examination scores and indicated school preference. Thus this systematically leads to a stratification of schools according to student ability or achievement. Consequently, it can be contended that this system strongly influences which individuals gain access to tertiary education because it incidentally creates groups of students with school level differences in academic attitudes, beliefs, and behaviors. That is, those attending lower achieving schools are more likely to exhibit behaviors and beliefs that are negatively related to academic achievement and, conversely, those attending higher achieving schools are more likely to exhibit behaviors and beliefs that are positively related to academic achievement. Hence, the results from this literature review suggested that the tracking & ranking system in the English-speaking Caribbean is an important predictor of achievement, but also, it raises concern for equity in education.

Psychosocial domain. Psychosocial factors are distinguished from social factors in that psychosocial factors in education are defined as psychological responses in a social context; thus, the roles and values of society influences the way individuals perceive themselves and interact with the world. Common psychosocial factors related to academic achievement include students' perceptions of their identity, self-competency, morality, and self-esteem/self-worth. There were three studies that investigated the psychosocial factor of identity; two explored perceptions of masculinity and the other academic identity. The main goal of these gender studies was to uncover cultural beliefs about masculinity in order to identify debilitating beliefs that fuel boys' underachievement.

The first study conducted by Parry (1996) took a naturalistic approach to investigate gender identities in single sex and coed secondary schools in Jamaica, Barbados, and St Vincent & the Grenadines. She found that masculinity was associated with an extreme macho masculine identity, and that of the three countries, these beliefs were most prevalent in Jamaica. Furthermore, cultural expectations and perceptions of masculinity in both Jamaica and Barbados regarded teaching as feminine, and studious boys were ridiculed by their peers and stigmatized as effeminate. Teachers also portrayed academic subjects in a gender-specific manner, and both sexes were encouraged to enter fields perceived to correspond to their gender. In addition, teachers were observed to have different academic expectations of boys and girls and administered harsher discipline and punishment to boys which was similar to the findings of Evans (1999).

Plummer, McLean, and Simpson (2008) provided the most recent study of gender identity through a grounded theory approach examining masculinity in eight Caribbean countries including Anguilla, Grenada, Guyana, St Kitts & Nevis, St Lucia, St. Vincent & the Grenadines, and Trinidad & Tobago. Their findings suggested that peer group had the most profound influence on boys' values and behaviors, and that often times, peers encouraged the hard, physical, risk-taking, aggressive behavior associated with masculinity. Moreover, their study confirmed previous reports of a growing widespread belief among Caribbean boys that high academic achievement is something a "real man"

would not do. Incidentally, this belief is reflected in the current enrollment of the University of the West Indies, where over seventy percent of the student body is female.

In addition to gender identity, student academic identity was also examined. To determine students' perceptions and attitudes towards education, Evans and Johnson (2001) used a mixed methods approach including surveys and interviews to examine the effect of single sex and coeducation on academic identity and achievement in Jamaica. These researchers found that although there was no significant difference in academic identity between students attending single sex versus coed schools, single sex students outperformed their counterparts in coed schools; girls in single sex schools outperformed everyone else; and girls and boys in single sex schools who agreed that hardworking students were perceived as unpopular had significantly lower grades than those who did not. More interestingly, survey results revealed that the image of the boy as a studious hard worker was less likely to be perceived as negative in the single sex schools. In a different vein, students who reported negative school experiences such as being beaten or disrespected had significantly lower achievement scores, with more negative reports coming from coed students.

Overall, research in the psychosocial domain is very limited and particularly more qualitative, but not surprisingly so, seeing that gender and identities are constructs that are continually redefined. From these gender and identity studies, the role of homophobia emerged as an important part of male socialization and perceptions of masculinity seem to play a substantial role in boys schooling and are implicated in predicting male achievement. The findings of Evans and Johnson suggested that Caribbean single sex schools may ameliorate the negative stigmatizing of academically inclined males, encourage more studious behaviors, and have environments that are perceived as more "safe". It is important to note, however, that single sex schools are generally respected in the Caribbean and are more likely to have higher ranking students, and Jackson (2009) reminds us that higher ranking schools tend to have students of higher peer quality.

Affective domain. There were three studies examining affective factors. The first explored learning-related behaviors (such as competence, motivation, attitude towards

learning, attention/persistence, and strategy/flexibility), anxiety, and attention as they related to academic achievement; the second explored changes in motivation and achievement in the context of a pedagogical intervention. Dubrow, Shaefer, and Jimerson (2000) investigated the relationship between learning-related behaviors, anxiety, and attention in primary school-age rural village children of St Vincent. These researchers postulated that the overcrowding, poor facilities, and physical punishment of students in developing countries possibly provoked higher levels of anxiety in students compared to industrialized countries. The data gathered was by means of various scaled instruments and academic scores. Quantitative analyses demonstrated that behavioral variables were better predictors of academic achievement compared to cognitive ability. Furthermore, these children demonstrated higher levels of anxiety and attention problems compared to the US norm population. A follow-up study done by these authors the subsequent year demonstrated similar results (Dubrow, Shaefer, & Jimerson, 2001).

The second study was a quasi-experiment design investigating the effect of a pedagogical academic intervention on student motivation and achievement in secondary schools in Trinidad and Barbados (Layne et al., 2008). The intervention was a relational approach to group work in classrooms, and data gathered included within-class scores, questionnaires, and reflective interviews. The results demonstrated that all students made significant improvements and lower achieving students made the most improvement in achievement. The students also demonstrated increased participation behaviors and were perceived by teachers as more motivated to learn.

Similar to the research involving psychosocial factors, the exploration of affective factors related to academic achievement was extremely limited, but in contrast, there might be a tendency towards more quantitative approaches in this domain. The limited research in both the psychosocial and affective domains suggests a need for more research at the classroom-level and that teacher pedagogical approach may mediate an increase in learning inside the classroom. The use of internationally developed instruments in these studies also calls for the development of psychological instruments that are adjusted or normed in the Caribbean.

Cognitive domain. There were two studies that investigated a cognitive factor in relation to academic achievement. The first examined the effect self-assessment had on the academic achievement of Barbadian secondary students' who were in their last year of school (McDonald & Boud, 2007). The second study was a comprehensive evaluation of a national school-based model intervention at ten percent of the most poorly performing primary schools in Jamaica (Lockheed, Harris, Gammill, & Barrow, 2006). McDonald and Boud employed a post-test only control group experimental design that selected secondary schools from the top, middle, and bottom levels of academic achievement and randomly assigned selected classrooms to control and experimental groups within schools. (Before random assignment, classrooms were pre-determined to be "equivalent" based on a selected set of criteria). The students in the experimental group were given self-assessment training over the school year and final examination scores were used as the outcome variable. The results demonstrated that students in the experimental groups performed significantly better than students in the control group. In a different vein, Lockheed et al. evaluated a wide scale intervention that took place in ten percent of Jamaica's poorly performing primary schools as an effort to raise student literacy and numeracy skills. Scores on the 6th grade secondary entrance exams were used as outcome measures and comparisons with a matched group indicated that significant improvements were found only on writing at the basic level. Other factors such as school location, administrative leadership, active PTA, schools' prior performance, and teacher experience and qualification were significantly related to gain scores.

The McDonald and Boud study was the only non-health related research that used an experimental design suggesting there is a lack of emphasis in using this method in educational research in the Caribbean. Furthermore, only three studies in this literature review implemented an intervention to address student academic achievement suggesting that interventions might not play a major role in the education systems of the Caribbean. Even if they do, the lack of published research makes it speculative as to whether the results of these interventions receive enough attention and are used to inform policy.

Health domain. The last domain that surfaced involving studies related to academic achievement in the English-speaking Caribbean included factors related to students' health. As stated earlier, a characteristic of many developing countries is the heightened occurrence of health related issues that are easily addressed through proper sanitization and health care. Developing countries are less likely to have adequate sanitization and health care protocols therefore illnesses caused by micro-organisms are more likely to occur. For example, the intestinal Trichuris trichiura is common to developing countries and it has been well documented that severe infections of this parasite hinders development. This parasite is also common in the Caribbean, and Simeon, Callender, Wong, Grantham-McGRegor, and Ramdath (1994) were interested in knowing if children infected with small to moderate levels of this parasite had lower academic attainment. These researchers obtained quantitative data on various academic and health measures and their results demonstrated that there was a significant negative association between school achievement and infection, even after controlling for SES.

As a follow-up study, Simeon, Callender, Wong, and Grantham-McGRegor (1995) investigated whether treating these students infected with T. trichiura had an impact on their academic performance. Through a double-blind, randomized treatment trial involving a treatment and placebo group, they found there was no significant main effect for treatment, though spelling improved with students who had high infections only. Similarly to Simeon et al. (1994), Hutchinson, Powell, Walker, Chang, and Grantham-McGRegor (1997) obtained a random sample of fifth graders from rural communities in Jamaica and examined the relationship between nutrition, anemia, intestinal parasitic infections and academic achievement. Quantitative analyses showed that even mild levels of intestinal parasitic infections were significantly associated with poor achievement levels after controlling for SES. These results suggested that further steps ought to be taken to address the needs of those who are mildly to moderately infected with this parasite.

In a slightly different vein, using a mixed methods approach, Walker, Grantham-McGRegor, Himes, Williams, and Duff (1998) examined the association between multiple factors associated with academic achievement including health, home

environment, aggression, sexual behavior and attendance. Eighth grade girls in inner-city schools in Jamaica were randomly selected from identified schools that were representative of low income groups because this group was more likely to have health related issues. Their results showed that anemia, sexual activity, and aggression had negative relationships with achievement whereas access to reading materials outside of school had a positive relationship with these girls' achievement.

Finally, Galler, Ramsey, Harrison, Taylor, Cumberbatch and Forde (2004), as part of an on-going longitudinal study, investigated the relationship between maternal moods, breast-feedings, infant growth, and academic performance using a cohort of secondary students in Barbados. Quantitative results demonstrated that there were significant positive correlations between infant length and achievement after correcting for maternal height and weight; a significant negative relationship between maternal despair and maternal anxiety after correcting for SES factors and sex of child; but no significant relationship between breast-feeding practices and academic achievement. These findings suggest that infant length and maternal moods can explain some variations in student achievement.

Overall, there were five studies investigating the relationship between health factors and academic achievement making this the domain the second most explored in education research in the English-speaking Caribbean. Three of these studies included some aspect of randomization therefore attempts in establishing causality were more plausible. From these studies then, it can be concluded that anemia and gastro-intestinal parasitic infections play a role in the lives of Caribbean students and account for some of the variations seen in academic achievement. Anemia has been linked to children's cognition, and treatment of anemia can improve cognitive functioning (Galler et al., 2004). In contrast, research on the effect of T. trichiura on children's cognition has been less explored; furthermore, current results implied that treatment might not improve the cognitive functioning of children who are mildly to moderately infected, but only those who are severely infected. This is of great concern seeing that many children, especially those from lower SES backgrounds, are mildly to moderately infected with this parasite

and mild to moderate infection has a significant negative relationship with cognitive ability.

Section I Summary

Academic research in the English-speaking Caribbean has utilized various qualitative and quantitative methodologies and approaches to examine factors related to academic achievement of K-12 students (Table 1). Quantitative approaches included correlation studies, surveys, experiments, and quasi-experiments, though use of the latter two was not as prevalent. Data analyses made use of cross sectional and longitudinal data with cross sectional data being the most dominant. Analyses included the use of descriptive statistics, independent sample *t*-test, multiple regression, hierarchical linear modeling, ANOVA, MANOVA, and propensity scores. Qualitative approaches included case studies, grounded theory, and ethnography with case studies being the most dominant approach. Methods included observations, interviews, and quantitative data collection; analyses included coding and the developing of themes as well as those mentioned above. Overall, there appeared to be a good balance between quantitative and qualitative measures which is a step towards a more holistic examination of the K-12 education systems; thus no body of knowledge appeared circumvented. Experimental and quasi-experimental procedures were limited to the health and cognitive domains, and perhaps this is due to the nature of the constructs the other domains involved. Nevertheless, it is still important to employ these more robust approaches so findings can be more conclusive and attempts of causal statements in all the domains can be made.

Table 1

Summary of Research Studies

Study	Focus	Approach
Social Domain		
Jimerson et al (2009)	Social factors and academic achievement at primary level	Quantitative surveys
Evans (1999)	Gender gap secondary level	Mixed methods.

		Quantitative survey of attitudes and beliefs & ethnography
Kutnick (2000 & 1999)	Gender gap at secondary level	Mixed methods. Quantitative analysis & case study
Lisle et al (2005)	Gender gap at primary level	Quantitative analysis
Kutnick et al (1997)	Gender gap secondary level	Mixed methods. Action research, survey, interviews
Smith & Ashiabi (2007)	Poverty and academic achievement	Literature review
Baker-Henningham et al (2009)	Violence and academic achievement at primary level	Mixed methods. Quantitative survey and interview
Durbrow et al (2002) Jimerson et al (2009)	Peer preference and academic achievement at primary level	Longitudinal study, quantitative analysis and peer nominating procedures
Jackson (2009)	Peer quality and academic achievement at secondary level	Cross-sectional cohort studies. Quantitative
Berry (2001)	Multi-grade classrooms and academic achievement at primary level	Ex post facto quasi-experimental longitudinal design
Bryan (1997, 1996) Sylva & Blatchford (1995)	Jamaican Creole in the classroom and academic achievement at primary level	Qualitative case study
Psychosocial Domain		
Parry (1996)	Gender identity and academics at secondary level	Naturalistic/ethnography
Plummer et al (2008)	Masculinity and academics at secondary level	Grounded theory
Evans and Johnson (2001)	Single sex vs coed schools, identity and achievement at secondary level	Mixed methods. Surveys and interviews
Affective Domain		
Dubrow et al (2001, 2000)	Learning-related behaviors and academic achievement at primary level	Pedagogical intervention. Quantitative analysis of attitudes and achievement
Layne et al (2008)	Pedagogical intervention on motivation and achievement at secondary level	Quasi experimental design. Mixed methods. Quantitative analysis of interviews
Cognitive Domain		

McDonald & Boud (2007)	Self-assessment and academic achievement at secondary level	Post-test only control group experimental design
Lockheed et al (2006)	Evaluation of a wide scale intervention in 10% of schools to raised literacy and numeracy skills at primary level	Matched group design. Quantitative analysis
Health		
Callender et al (1994)	Trichuris trichiura parasite and academic achievement at primary level	Quantitative analysis
Simeon et al (1995)	Trichuris trichiura parasite and academic achievement at primary level	Double blind, randomized trial. Quantitative analysis
Hutchinson et al (1997)	Trichuris trichiura parasite, anemia, nutrition and academic achievement at primary level	Random sample. Quantitative analysis
Walker et al (1998)	Health, home environment, aggression, sexual behavior, attendance and academic achievement at secondary level	Random selected from low income group. Quantitative analysis
Galler et al (2004)	Maternal moods, breast feeding, infant growth and academic achievement at secondary level	Longitudinal cohort effect. Quantitative analysis

Various authors mentioned the limitations of the empirical data collected in national databases and these limitations were often due to insufficient variables of interest being collected, selection bias due to the nature of the tracking system, and non-centralization of the data (Jackson, 2009; Jimerson et al., 2009; Lisle et al., 2005; Lockheed et al., 2006). Perhaps the lack of sufficient variables of interest being collected is a consequence of rigorous research not being part of Caribbean history. It is important that education research in the Caribbean begin making large strides towards establishing a strong research community and to remedying this deficit in data and knowledge base. Various psychological instruments used in research in the psychosocial and social domains were often developed outside the Caribbean and only in a few cases were steps taken to verify the validity and reliability of these instruments. Thus, not only is there a need for more efficient data collection methods, but also a need for the development or modification of instruments that are more apposite to Caribbean students.

The majority of the studies presented data related to the achievement gap between the sexes demonstrating that male underachievement is the topic of concern in Caribbean education and political systems. If the representation of the domains is a proxy for what research is perceived as important in the Caribbean, then social and psychosocial factors by far take predominance. The importance of the other domains then would be as follows; health, affective, and finally cognitive with the psychological domain not being important at all. Similar to other developing countries, there are heightened health concerns throughout the Caribbean and this is portrayed in the health domain ranking as number three. Alarmingly, there was very little research on cognitive factors addressing student achievement; furthermore, there were only three studies that implemented an academic intervention to raise student performance suggesting that interventions play a small role in Caribbean education systems at the school or classroom level.

All of the studies concentrated on primary and secondary school populations and this reflects a history of a lack of emphasis and perceived unimportance of early education in the English-speaking Caribbean. In fact, public preschool and kindergarten options are not available for many Caribbean communities and this is of great concern because young children (especially the poor) are not being exposed to learning opportunities and cognitive stimulation at crucial ages (Sylva & Blatchford, 1995). There is also a need for early childhood and primary school interventions and assessment tools to identify students who are at risk from an early age (Dubrow et al., 2000; Lisle et al., 2005; Lockheed, 2006; Sylva & Blatchford, 1995).

Another hindrance to raising student achievement is the lack of qualified teachers that are appointed to schools (Harvey, 2000). Historically, qualified teachers have been appointed to the better performing schools at the secondary level, whereas untrained teachers have been placed in the primary schools, lower performing secondary schools, or more rural areas. This trend still continues in some of these countries though more recently there is a push for all teachers to obtain pedagogical training and licensure. Education research in the USA demonstrates that teacher qualification has a positive relationship with student achievement (Darling-Hammond, 2000), therefore it is

important that only qualified teachers are hired at all levels and locations of the K-12 school systems.

It was of interest to compare findings regarding trends in educational research in the English-speaking Caribbean to what has been found in other developing nations. Fuller's (1987) meta-analysis investigating school factors that raised achievement in developing countries found that after controlling for SES, simple inputs such as textbooks, quality and length of teacher training, teacher social class background, and length of time spent on subject matter were important predictors of student achievement. Furthermore, he also found an interaction effect between simple inputs, student location, and student SES where more rural and lower income students benefited more from simple inputs compared to students situated in urban middle class areas. Consistent with findings from this literature review of the Caribbean, he pointed out that research in developing countries tend to have very little emphasis on cognitive abilities, instructional practices, student experiences at the classroom level, and the effect of pertinent school-type factors on classroom achievement.

Section II: Evaluation Practices in the Eastern Caribbean

The previous section presented research findings regarding factors affecting academic achievement in the English-speaking Caribbean. This section presents evaluation studies regarding the progress of education development in this region in an attempt to identify points of intersection between the two fields. There have been at least four regional initiatives/projects established during the past 20 years to improve the equity, efficiency, and quality of education in the Caribbean, and these initiatives/projects still continue till present day. The first is the Education for All (EFA) initiative that was established at the United Nations conference in Jomtein, Thailand in 1990. The second is the Universal Secondary Education (USE) reform in the Eastern Caribbean which endeavors to improving access to secondary education for all students graduating from primary school. The third is the Organization of Eastern Caribbean States (OECS) education development project which is aimed at building human capital in the OECS

countries by increasing equitable access to secondary education, improving the quality and efficiency of secondary education, and strengthening the institutional capacity of the educational sector. The fourth is the Early Childhood Education Care and Development (ECECD) initiative established by the Caribbean Community (CARICOM) which is aimed at providing quality early childhood education in this region. All of the evaluation studies presented below have assessed at least one of the goals of these four initiatives/projects.

The practice of evaluating education interventions in the Eastern Caribbean has only recently began to take root over the past twenty years and it has been in response to the initiatives/projects outlined above. This section focuses on evaluation studies conducted by the World Bank and UNESCO only because these studies were more readily accessible. For the purpose of this paper, the population of the Eastern Caribbean includes the English-speaking Caribbean as well as Guyana, Suriname, Belize, Haiti, and the Dominican Republic. Guyana, Suriname, Belize, Haiti, and the Dominican Republic are included here in Section II because their countries share many similar characteristics to the English-speaking countries and their evaluation reports were written in English.

In response to the four initiatives outlined above, many of these countries formed an Assessment and Evaluation unit/Task Force unit or some unit of like manner inside their Ministries of Education department as a means of establishing a foundation for the beginning stages of systematic data collection and analysis. Subsequently, the individual countries produced reports that served as valuable resources for the evaluation efforts conducted by the World Bank and UNESCO. Oftentimes, the World Bank and UNESCO conducted a rapid review assessment of these reports to provide an overall synthesis and summary of what is taking place in the Eastern Caribbean. The goals of this section are to:-

1. determine what evaluation approaches and methodologies were utilized
2. present the relevant findings from evaluation studies that pertained to K-12 academic attainment and achievement
3. pinpoint areas where the findings from education research coincided with or appeared to inform evaluation studies

4. identify any shortcomings in the evaluation processes and suggest areas of improvement.

World Bank Evaluations. According to their website, the World Bank conducts impact evaluations through an objectives-based approach which includes performance rating criteria for: relevance to country's needs, production of outcomes, sustainability, institutional development impact, and bank and borrower performance. The evaluation process is two-fold. It includes an internal evaluation study conducted by its staff, and a second external study conducted by their Independent Evaluation Group (IEG). The following evaluation reports were found on the World Bank's webpage for education evaluations completed in the Caribbean. They are presented in chronological topical order to best portray the progress of evaluation in the Eastern Caribbean during this time.

Lockheed and Jimenez (1994) examined the relative effectiveness and efficiency of private and public secondary schools in five developing countries through a multi-case study approach. The Dominican Republic represented the Caribbean country included in this study. The private and public sectors were surveyed to determine why the private sector was relatively more effective. It was determined that the private sector was more effective primarily because private schools had a better internal management system and were able to make educational decisions at the level of the school site. Other findings that seemed to contribute to their effectiveness were that they had students who were more capable and they tended to invest more in resources for instruction than in personnel. Interestingly, the findings also demonstrated that per student expenditures were actually lower in privates schools, therefore their greater effectiveness could not be attributed to a greater abundance of resources. Conversely, the public sectors had less able students in a larger but simpler organized setting, and they tended to invest more in personnel resources.

In November 2002, the OECS countries embarked upon a multi-country collaboration approach to build human capital in the OECS with the goal of diversifying their economies and establishing more sustainable growth. An implementation evaluation study for the first phase of the project was first conducted using data from two

of these countries (St Lucia and St Kitts & Nevis) because at this time, only these two countries met the implementation criteria (World Bank, 2002a). The methodology included a cost benefit, cost feasibility, and education expenditure analyses to determine: the net benefits of the project in line with specified targets, whether the project was viable in economic terms, and what was the state of expenditure for education at that time. The results demonstrated that the project indeed was quite beneficial and viable. They also demonstrated that the governments were giving increasing priority to education as indicated by the increasing share of their national budget from 1995 to 2001. On a more negative note, it was found that there was a serious imbalance in the allocation of non-salary operating costs in the secondary sector.

Follow-up studies on the implementation and completion of the above project were conducted in 2009 for both countries (World Bank, 2009a and 2009b). The methodologies utilized in both countries were quantitative descriptive summaries and economic analyses similar to the ones above. Additionally, St Lucia incorporated field visits and St Kitts incorporated focus groups. The assessment of objectives revealed that for both countries, the project designs were in line with the national strategy for reform. The project implementation findings demonstrated that in St Kitts & Nevis, but not St Lucia, there was strong participation and ownership of the Government. Also, both countries had experienced challenges which slowed the implementation process of the projects. For example, St Lucia suffered from staff turnover and St Kitts suffered from slow decision making processes.

The assessment of outcome findings for St Lucia demonstrated an improvement in access to secondary education, but similar to St Kitts, there was a decrease in average student achievement. It was postulated that this decrease was due to the fact that students of all abilities now had access to secondary education and the opportunity to sit the exams, whereas before, only those of average or higher ability tended to do so. Also, the indicators to measure quality and management objectives were not clearly linked to some of the activities, and adequate intermediate indicators were not defined to monitor progress. There was some evidence though that the quality objective was partially achieved given the improvement in student support, school environment, and learning

environment. Finally, there was an increase in capital and non-salary recurrent expenditure at the secondary level which met satisfactory requirements.

Other outcome findings for St Kitts were on a more negative note. First, the indicator measuring the quality objective linked to school completion was not sufficient because the indicators did not distinguish between dro*p*-outs and those who leave school before the last year to pursue vocational education. Second, the outcome indicators for the management objectives were not clearly linked to the output indicators so it wasn't clear how these indicators assessed improved management in school systems. In addition, the proportion of non-salary recurrent expenditure did not reach its target. Also, although the data collection capacity at the country's school management level did increase, there was no use of the data. On a more positive note, the findings for the quality indicators demonstrated that there was an improvement in student learning environment at the secondary level, an improvement in the reading skills of disadvantaged students at the primary level, and an improvement in teacher quality.

Another World Bank study utilized a multi-case study approach using interviews and literature reviews to obtain data from several developing countries to examine the impact of first and second languages as the medium of instruction inside classrooms (Dutcher & Tucker, 1997). Haiti was one of the countries included in this study and the focus was on equity and access to education as it related to the language of instruction inside its schools. This study found that until the 1980s, only a small percentage of Haitian nationals were granted access to education, and this group represented the urban elite. Less than half the children in rural areas were enrolled in school and only about 20% of them finished the sixth grade. Of those who finished grade six, achievement was low and it was postulated that this was because the education system used French as the medium of instruction, instead of the mother tongue, Creole.

Thus, in 1982, a major reform which included using Creole as the language of instruction. At first, many parents resisted the use of Creole in the schools because they saw it as the government trying to provide second class education, and eventually, the entire reform became a political affair which caused much controversy. In 1987, the World Bank and UNESCO conducted a large scale evaluation on achievement using a

sample of students in grades four and six who had been exposed to the reform for up to six years. Outcome findings demonstrated that fifth and sixth grade students attending traditional schools outperformed students attending the reform schools; however there seemed to be more achievement gains amongst students attending the reform schools. Furthermore, the location and religious affiliation of the schools accounted for more variation in student scores rather than reform versus no reform. Thus, it was surmised that the reform at worst did not hinder learning. However, more important factors related to student achievement were the availability of well-trained teachers, materials, and good school management as proxied by school location and affiliation.

One of the more recent comprehensive education evaluation studies of the Eastern Caribbean was undertaken by the World Bank in 2003 (di Gropello, 2003). It was a two stage evaluation utilizing progress assessment and monitoring to:- define a set of operationally relevant education indicators for this region; to provide a database of comparable education indicators in Caribbean countries where data was available; and to propose methods on how the common set of indicators can be used for analyses of the education sectors. This study used statistical data from individual Eastern Caribbean countries and previous reports by the World Bank and UNESCO to conduct its evaluation. In particular, the indicators identified were the ones suggested by Jules and Pannaflek (2000) in their synthesis report of EFA for UNESCO described later on in this section. The analyses of coverage indicators included completion & survival rates analyses, and the analyses of efficiency indicators included cost-effectiveness analysis. Quality indicators were limited to using national and international standardized tests for education achievement. Intermediate quality measures were also indentified but were not able to be measured. Thus, although indicators for EFA objectives were defined, this evaluation found that it was difficult to make robust comparisons across the countries because the length of school cycles differed and there was a lack of data for many of the countries.

A second comprehensive World Bank country study examined whether the education systems in the Caribbean adequately prepare youth for the global economy (Blom & Hobbs, 2008). The methodology included case studies, surveys, and a literature

review of analytical papers authored by Caribbean and international experts regarding this topic. Survey findings indicated that although the OECS countries were doing curriculum reforms, overall, there is a lack of labor market information for these countries therefore few education systems can base policy on data from the labor market. Additionally, there is a lack of skilled workers available so companies are forced to hire expensive foreign trained staff which hinders local economic benefits. To make matters worse, there is a low enrollment in post-secondary education which is unfortunate because the results of this study indicated that few people who complete secondary education are trapped in poverty and that this rate is even lower among those who complete tertiary education. Lastly, the average youth unemployment is high compared to the global rate (32% versus 14%). Thus, in summary, there appear to be major shortcomings in Eastern Caribbean school curriculums for preparing youth for the global economy.

UNESCO Evaluation studies. UNESCO took the lead in the Eastern Caribbean to undertake evaluation studies and document the progress of education in this region (diGropello, 2003). UNESCO's studies were authored by various researchers and other expert contributors and were compiled in a monograph series dating between 1990 and 2000. Unlike the objectives-based approach of the World Bank and its systematic utility of internal and external evaluation processes, these studies included a variety of essays, case studies, reflections, research studies, and other reports. Thus, in an attempt to portray the more credible findings, the evaluation studies discussed below are only the ones that assessed the progress of a problem, or gave an overall judgment of an intervention or initiative that was implemented during this time. These reports are presented according to topic; the first set of studies are evaluations for the EFA initiative, the second set are evaluations for early childhood interventions, and the last are evaluations for primary and secondary school interventions.

EFA. A rapid review approach was employed to make an initial assessment of the progress of EFA in the 1900s (Miller, 2000). In particular, this study examined how the

Eastern Caribbean as a whole responded to the challenges posed by the *Framework for Action* at Jomtein, 1990. The methodology included a review of published documents and monographs submitted as part of the EFA assessment process. It was found that in general, the Eastern Caribbean countries had chosen to respond to the EFA initiative in one of two ways. Some countries had adopted a comprehensive reform strategy plan in response to the initiative and other countries had adopted a project driven approach. To implement the reform, the OECS countries worked in collaboration with each other and had drawn on expertise for consultation in this sub-region. Interestingly, the countries that originally adopted a project driven approach moved to a more comprehensive approach towards the end of that decade, suggesting that the comprehensive approach was more practical.

This study also found that although target objectives for access to basic education were met during this decade, the progress was almost insignificant in light of the fact that school curricula no longer seemed appropriate for preparing students for the demands of the labor market. Other findings involved the validity and reliability of the data collected. For example, students attending private schools were inconsistently accounted for by the countries' gross total enrollment, thus analyses involving student enrollment data were not accurate. In addition, although the data collection and analyses capacities of the Ministries of Education had improved during the decade, there remained too many inaccuracies in the base-line data to make reliable trend comparisons. Also, there still remained a lack of systematic efforts to monitor and measure the impact of interventions.

A preliminary synthesis report conducted by UNESCO was completed at the beginning of the 21st century (Jules & Pannaflek, 2000). This synthesis suggested 18 education indicator variables for the Ministries of Education in each country to gather data on so robust comparison of countries could be made. As most countries did not have the data on these variables, it was decided that each country should begin to systematically collect and compile its own database to account for these indicators. For countries that did provide information, it was found that there was a widening gap between the total number of students accounted for and the actual number enrolled into first grade. (This though may be due to the problem of inconsistent accountability of

students enrolled in the private sector). There was also no correlation between education expenditure and the rate of enrollment at the primary level, but there was a positive correlation between primary student achievement, expenditure, and percentage of qualified teachers. Interestingly, another finding was that both boys and girls survive primary school equally well, which suggests that boys' underachievement may be more pronounced at the secondary school level.

Early Childhood Interventions. An impact assessment of the Early Childhood Education Care and Development (ECECD) initiative was conducted in 19 of the 22 Eastern Caribbean countries using a participatory approach to gather the data (Charles, 1999). The methodology for this evaluation included a literature research and quantitative survey of the progress ECECD had made in these countries. The impact assessment found that there was a lack of systematic data collection for the ECECD initiative, lack of systematic management, only six countries had developed targets and legislative framework to address initiative, only 11 had developed early childhood action plans, and only seven countries provided usable data. Thus it was difficult to determine progress as a whole for CARICOM because there was little empirical evidence to show whether outcomes had been achieved.

In Guyana, a five year education intervention was implemented to create a smooth transition from nursery to primary school in five school regions. The objectives of this program were to: better prepare young children for primary school so they would not drop out or repeat grade levels; to raise awareness of the needs and concerns of children; to introduce more child-centered teaching methods; and to motivate students and parents to become more involved in the learning process. This impact evaluation utilized phenomenology to document the lived experiences of the children, teachers, and parents involved in the intervention (Rodrigues, 2000). The methodology included interviews, surveys, community meetings, focus groups, observations, and a content analysis of documents describing the intervention. Overall, the project was judged as a success. The findings indicated that on average, the repetition rates declined during the five years of the intervention and the curriculum was judged as being more child-centered. In

particular, the intervention was very successful in one of the regions and this was attributed to the close interaction between the nursery and primary schools, coordinated workshops, very active parent involvement, and positive attitudes among stakeholders. On a slightly negative note, overall, the parents did not appear more sensitized and involved in the learning process.

In Suriname, a project called the Child Minders Initiative was implemented in eight villages as part of a developmental strategy to serve the tribal people of the hinterland of Suriname. The Child Minders Initiative was an example of a poverty alleviation program for isolated indigenous groups aimed at reducing early school dro*p*-out. This evaluation was an impact assessment of the pre-school facilities created through this program (Ketwaru-Nurmohamed, 2000). The methodology included a rapid review of the on-going reports, visits to the villages, interviews with participants and stakeholders, focus groups, and team meetings. Interview data suggested that this intervention was promising, as indicated by first grade teachers reporting that students who had received this intervention in pre-school appeared less shy, more disciplined, exhibited more active participation, and had better social skills compared to ones who did not. However, the intervention was short-lived (less than a year in all but one village), and it was difficult to determine whether it met its objectives because there were no copies of the project proposal available for the evaluator. Furthermore, an assessment of the adults trained to be Child Minders was not possible because, at the time of the evaluation, all of the activities had stopped due to lack of school supplies and facilities.

Primary and Secondary school Interventions. Similar to the above intervention, the project Escuela Neuva was implemented in the hinterland regions in Guyana in 1998 as part of the Amazon project. The goal of the project was to deliver quality primary education to the children residing there. This project was modeled after The Escuela Neuva school improvement project in rural Colombia of 1975. This project was adopted in Guyana even though it was first implemented in Colombia because one of the key assumptions of the Escuela Nueva was that all mechanisms were replicable, decentralized, and viable.

The pilot implementation in Guyana originally included three primary schools that received all of the Escuela Nueva training and techniques, and an additional nine schools that were located near these three schools that also received some sort of training. After four years of the project, an evaluation study was conducted to determine what type of baseline data was important to collect in order to establish an Escuela Nueva index (Dongen, 2002). Future use of this Escuela Nueva index would include quantitative analyses to determine what components of the project should be kept and what should be dropped, as well as on-going monitoring and assessment of the project. The evaluation study included survey analysis, interviews, and focus group meetings with stakeholders and participants. This evaluation was very successful in obtaining baseline measures for a number of indicators for the project; for example, reliable measures of general school demographics relating to the student and teacher population; the child-friendliness of the school and classroom environments; the availability of resources; the level of teacher training; and how connected the school and community were. Overall, the evaluation study allowed the project to develop an Escuela Nueva index that reliably measured the extent to which Escuela Nueva was implemented in schools.

Belize implemented a Primary Education Development Project which was funded by the World Bank from 1992 to 1999. This project was evaluated using a qualitative multi-case study approach including observations and analysis/synthesis of individual reports written for each case (Bennet, 1999). This study included 11 primary schools and it assessed the project's progress in relation to the improvement of 1) quality teacher training at the primary level 2) education facilities and teaching resources, and 3) planning and management of education. Findings from this study indicated that overall the project was modestly effective. For example, more teachers were trained in completing at least the level 1 teacher qualification requirements compared to before the project, and the textbook loan increased book access from 30% to 75/80% at some schools. There were still areas, however, where improvement was needed. For example, it was determined that the Assessment and Evaluation unit in the Belize Ministry of Education department needed an increased capacity for functioning, test development, and test administration skills. Also, planning and management at the school levels

remained inefficient, and there was still a lack in teacher support for organizing and teaching strategies.

Another nationwide school reform program implemented in Belize in 1999 was the School Health and Physical Education Services (SHAPES) program. This was a multi-ministerial program (Education, Health, Agriculture) designed to improve the accessibility of health service in schools including nutrition and food safety at K-12 levels of education. An impact assessment of SHAPES used an integrated approach of reviewing SHAPES documents and conducting interviews with stakeholders/participants of the program to determine its success (Iyo, 2001). This study used clustered and stratified random sampling of schools to ensure the generalizability of findings. It was found that overall SHAPES was a failure for a variety of reasons which included an overly ambitious goal that was too vague, lack of government follow through with technical resources, lack of data collection, lack of training of personnel, lack of school resources for physical education and sports, and lack of promotion nation-wide.

Lastly, the Eastern Caribbean had implemented the Associated Schools Project Network Caribean Sea Project (ASPNet CSP) in 1994. It was established first in Trinidad & Tobago and expanded to other Caribbean countries. This project was a curriculum intervention designed to increase secondary student awareness and improve attitudes towards marine and environmental issues in the Eastern Caribbean. A formative evaluation of this study was performed three years with the purpose of identifying areas where students lacked knowledge so to inform curriculum improvement (Gift, 1999). The methodology included systematically sampling students in identified schools and surveying them with items based on the objectives of the programs. Although the evaluators were able to identify areas where students had a lack in knowledge, there was no baseline data to compare these results too, hence there was no way of knowing whether the project had any impact on students understanding of the marine environment. The data collected here then, was proposed to be baseline data for future assessments.

Section II Summary

These evaluation studies largely assessed five factors related to education in the Eastern Caribbean :- early childhood care and development, primary education, learning achievement and outcomes, training in essential skills, and education for better living. The World Bank has identified five principal contributors to primary education effectiveness in developing countries: 1) curriculum, 2) learning materials, 3) instructional time, 4) classroom teaching, and 5) student's learning capacity (Boissiere, 2004). To their credit, 12 of the 16 evaluation studies cited above focused on at least one of these five, however, the focus was not narrow enough to conduct analyses at the school or student level. These contributors to education effectiveness are also known as quality indicators, and are the inputs or processes that are linked to student academic achievement (Miller, 2000). The findings from the evaluation studies demonstrate two major shortcomings in the strategic plans of the interventions. The first is that the quality indicators are not very well linked to the educational outcomes in the Eastern Caribbean, and the second is that the measured outcomes are themselves very limited in scope. These two facts may be the Achilles heel of why there is an absence of evaluation studies assessing interventions directly related to student academic achievement at the school and student levels.

The evaluation studies presented above included an assessment of early childhood, primary education, and secondary education outcomes, which is in contrast to education research studies that included only primary and secondary education outcomes. At the beginning of the 1990s, the focus was on improving access to primary education. However, since the Eastern Caribbean is one of the leaders amongst the developing countries in providing universal primary education (Miller, 2000), this fact has allowed interventions and evaluations to be conducted at all levels of K-12 education. Currently, the focus of education reform is shifting from access to primary and secondary education to access to early childhood education—a step towards rectifying the lack of attention that has historically plagued early childhood education in the Eastern Caribbean.

Overall, the evaluation reports demonstrate that both formative and summative evaluations were carried out to assess the progress of education reform in the Eastern Caribbean. The orientation of these evaluations tended towards empowerment. Many of the studies were conducted through collaborative efforts with key stakeholders, government officials, and participants, locally and sub-regionally to facilitate ownership of the initiatives and programs. A few of the studies had adopted a participatory approach and collected data from participants of the project. The evaluation studies represent a combination of qualitative and quantitative methods including case studies, rapid literature reviews, surveys, interviews, economic analysis, and to a lesser extent, observations.

According to Regeer, Hoes, van Amstel-van Saane, Caron-Flinterman, and Bunders (2009), the three main evaluation approaches to monitoring and evaluating sustainable development are progress assessment, goal-oriented program evaluation, and program theory evaluation. The authors contend that these three approaches can also be seen in the domain of education evaluation. Accordingly, all of the evaluations presented in this literature review fall into the first two categories; five being progress assessments, seven being goal-oriented assessments, and four falling into both categories (Table 2). Progress assessments are necessary to establish baseline data to make future comparisons of outcomes. This lack of systematic organization of data collection in the Eastern Caribbean speaks to the need for progress assessment evaluations in this region.

Table 2

Summary of Evaluation Studies

Study	Focus	Type of principal contributor to education effectiveness under study	Approach
Lockheed & Jimenez (1994)	Public vs Private Schools	Student learning capacity	Goal- oriented (impact assessment)
World Bank (2002)	Preliminary Analyses for OECS education projects	NA	Progress assessment

World Bank (2009a &2009b)	Education Development Project	Learning Materials & Classroom Teaching	Goal-oriented (impact assessment)
Dutcher & Tucker (1997)	Creole as medium of instruction in French schools	Classroom Teaching	Progress and Goal-oriented (impact assessment)
diGropello (2003)	Education indicators	NA	Progress and Goal-oriented (impact assessment)
Blom & Hobbs (2008)	Education system and global economy	Curriculum	Progress assessment
Miller (2000)	How the Caribbean responded to the EFA initiative	NA	Progress assessment
Rodrigues (2000)	Smooth transition from nursery to primary school	Curriculum	Goals oriented (impact assessment)
Jules & Pannafleck (2000)	Education indicators	NA	Progress assessment
Charles (1999)	Early childhood education care and development project	NA	Progress assessment
Ketwaru-Nurmohamed (2000)	Child Minders in Suriname project	Curriculum, Learning Materials	Goals-oriented (impact assessment)
Dongen (2002)	Escuela Nueva index	Curriculum, Learning Materials, Instructional Time, Classroom Teaching	Progress and Goal-oriented (Impact assessment)
Bennet (1999)	Belize primary education development project	Classroom Teaching	Goals-oriented (impact assessment)
Iyo (2001)	SHAPES	Curriculum, Learning Materials	Goals-oriented (impact assessment)
Gift (1999)	UNESCO AspNet project	Curriculum	Progress and Goal-oriented (impact assessment)

The World Bank's objective-based approach to evaluation has a number of advantages. First, this approach is easy to understand/follow/implement. Second, the literature is extensive and filled with creative ideas for applying this approach. Third, it

carries face validity, and fourth, it has a clear value basis for judging the program (Fitzpatrick, Saunders, Worthen, 2004). Given that many of the impact evaluations for UNESCO were conducted by personnel untrained in social science research methods, the necessity of a simple evaluation system is crucial to the evaluation process taking place in that organization.

A number of factors suggest that this region would greatly benefit from the use of program logic models for planning interventions. These factors include: 1) many of the evaluation studies in the Eastern Caribbean are being conducted by untrained personnel, 2) oftentimes the intermediate outcomes are not specified, 3) the linkage between outputs and outcomes are not clear, and 4) the efficiency of the country level task force units for data collection and analysis is poor. Program logic models are a type of objective-oriented evaluation approach and they require the specification of:-

1. Inputs –such as budgets, staff, learning materials, etc needed to run the program
2. Activities – such as planned weekly sessions, workshops, recruitment, training, advertising etc that ensure the program is accomplishing what it sets out to do
3. Outputs – such as new school buildings, development of new curricula, the establishment of student special need services, etc
4. Outcomes – these are intermediate, long-term, and ultimate changes we want seen in the target population receiving the intervention (Fitzpatrick et al., 2004).

Logic models "support design, planning, communication, evaluation, and learning. They are often used when explaining an idea, resolving a challenge, or assessing progress. They can untangle and clarify complex relationships among elements or parts" (Knowlton & Philips, 2009). Logic models are easy to read and they present the big picture, as well as the tiny details that ought to be accounted for. Thus, logic models can guide untrained personnel in the type of data that ought to be collected, help key stakeholders set reasonable and feasible goals for desired outputs and outcomes, inform on which outputs are linked to which outcomes, remind stakeholders of what is required

for an intervention to be successful, and help evaluators determine why certain outcomes were not achieved.

Another evaluation approach that would prove valuable in the Eastern Caribbean is planned variation (Yeh, 2000). This approach, however, would only be useful after these countries have developed and implemented detailed logical models for their interventions; established efficient systems of data collection and monitoring; and have created a comprehensive regional database. Planned variation would be especially feasible among the OECS countries because they share very similar characteristics and have already established a common approach to education reform. According to Yeh (2000), the goal of planned variation is to "build knowledge about particular components or mechanisms for improving program effectiveness, thereby fostering the utilization of evaluation findings". Planned variation requires the manipulation of one program component to be manipulated (the test variable) while the other components to be held constant (thus serving as controls), One use of planned variation then would be for these countries to test certain components of interventions and help them determine the most cost-effective route. This is especially attractive because the OECS countries have very limited budgets for their public expenditure for they are relatively poor countries. Planned variation can also help these countries determine which teaching strategies are most apposite for their students, which management strategies are the most efficient, and which outputs cause the maximum desired outcome.

Section III-Suggestions for Future Research

The resource allocation for education made by most Eastern- Caribbean governments demonstrates that the Caribbean has placed great importance to the education of its people, with public spending in this region being higher on average than non-Caribbean developing countries (Leacock, 2009; Swaroop,1996). As it stands, most of the Eastern Caribbean countries have reached their goals of providing universal primary education and at least half have achieved providing access to secondary education. However, the quality of education - as indicated by the results of standardized

regional school-leaving exams and meeting the needs of the labor market - seems low (Warrican, 2009). The fact that the returns from investing in education and completing tertiary education in the Eastern Caribbean is high (Blom & Hobbs, 2008) suggests that efforts need to be concentrated on revising and developing curricula that are student-specific so that learning is beneficial for all types of learners e.g. special need, gifted and talented, average-learners, adult-learners etc. Also, it is necessary to align curricula to the market needs of the Caribbean economy so school leavers are more prepared for the workforce.

As presented in Section I, research has been instrumental in identifying factors related to student academic achievement in this region. Even more so, over the past ten years, an effort has been made by education researchers in this region to connect the goals of education reform and the findings from evaluation studies to more systematically identify and explore these quality indicators as they related to academic achievement (Armstrong, Armstrong, Lynch, & Severin,2005; Jennings, 2001; Kelly, 2009; Lam, 2011; Leacock, 2009; Thompson, 2009; Schrounder, 2008). Evaluation studies then can include these factors in the planning and assessment of interventions geared towards student achievement, and make more sound judgment at the country/regional level as to whether or not these factors are valuable to educational outcomes in the Eastern Caribbean.

The practice of research and evaluation is a vital component in the Eastern Caribbean for the improvement of education systems. Although there are fundamental distinctions between the two fields, together they provide a clearer and more rounded picture of what is transpiring in this region. Furthermore, their findings suggest future directions that must be taken to improve the education systems in terms of access, equity, efficiency, and quality of education in this region.

Together, they both demonstrate that:- 1) more emphasis is needed on early childhood education, 2) the data collection and management systems are largely inefficient, 3) there is a lack of assessment of school and student level outputs and outcomes, and 4) there is a need to operationally define student outcomes other than just student academic achievement. Thus, in the establishment of a sound research

community, improvement of data collection methods, and the building of a centralized knowledge base that can inform education policy, these findings from education research and evaluation in the Eastern Caribbean suggest a number of directions for future research. These directions are posed as questions below and they are as follows:

Questions

Social Domain

1. At what grade or school level does male underachievement emerge?
2. Is the academic gap between males and females as prominent in other English-speaking Caribbean countries such as the British and U.S. Virgin Islands and The Bahamas where there is no tracking system?
3. What types of schools in the English-speaking Caribbean ameliorate the achievement gap between boys and girls? What are possible mediators or moderators that can explain these discrepancies in schools?
4. What is the relationship between teacher quality and student achievement in the K-12 education systems?

Cognitive Domain

5. What impact does early education have on the achievement of students in the later years?
6. What measures have been taken to improve academic achievement, and are these measures mostly at the school, teacher, or student level?

Affective Domain

7. What impact does the type of school assigned have on student academic achievement, and what are the mediating variables that explain this relationship?

Evaluation Research

8. What is the nature of the common secondary exams administered to 11 and 12 year olds in the English-speaking Caribbean?
9. What is the relationship between evaluation, research, and education policy in the English speaking Caribbean?
10. What role can planned variation play in future evaluations of education systems in the OECS countries?
11. What is the program theory behind the EFA, USE, and ECDEDP interventions of the English-Speaking Caribbean?
12. Given the limited capacity of country-based evaluators in this region, what evaluation models can best serve the goals of the EFA initiative and other reforms in the English-Speaking Caribbean?

CHAPTER III: METHOD

The Database

Data for this dissertation came from the Longitudinal Study of Young People in England (LSYPE) database. The LSYPE is an on-going large-scale longitudinal panel study of young people in England which began in 2004 when the individuals were 13 and 14 yrs of age. This study collects data in yearly intervals and at the time this database was obtained, it had already collected 6 Waves of data, from 2004 to 2010. The purpose of the LSYPE is to examine the impact current policies have on this group of young people and to provide an evidence base for further policy development in England. This database was chosen because it contains a sizeable representation of students of Caribbean descent, and therefore lends itself to examining the proposed research questions.

Information in this database was collected from interviews that were conducted with the Young Person, the Main Parent, and the Secondary Parent. The information collected provides data about;

- the Young Person's family background,
- Parent's socio-economic status
- Personal characteristics,
- attitudes, experiences and behaviors,
- attainment in education,
- parental employment,
- income and family environment as well as local deprivation,
- the school(s) the young Person attends/attended
- the Young Person's post-16 plans and activities

Complex sampling procedures were conducted to ensure that a sizeable sample of each ethnic group were represented in the database. For more detailed information about

the sampling procedures, see the LSYPE user guide manual found at this website: http://www.esds.ac.uk/longitudinal/access/lsype/design.asp.

As of 2010, Wave 1 of the LSYPE had 15,770 households; Wave 2 had 13,539 households, Wave 3 had 12,440 households, Wave 4 had 11,801 households (and also underwent an ethnic boost), Wave 5 had 11, 793 Young Person cases; and Wave 6 had 11,225 Young Person cases. Design weights, wave weights, and panel weights were calculated to account for survey design.

Missing data. The LSYPE experienced participant dro*p*-out over time, as evidence by the decrease of individuals from Wave 1 to Wave 6. According to the LSYPE manual, these missing individuals were disproportionately represented by minority ethnic groups, therefore a sample boost occurred at Wave 4. Due to the fact that individuals beyond Wave 3 were not the same as those at Wave 1, this dissertation examined data from Waves 1 through 3 only.

Individuals who had dropped out of the study over time were coded in the LSYPE database as -99. Aside from individuals being absent at certain time points, data was also missing due to a variety of reasons. Below (Table 3) are the codes the LSYPE database used to explain why the data was missing.

Table 3

Missing data codes in the LSYPE database

Numeric Code	**Explanation of Code**
-1	Don't Know – enables respondents to answer don't know to questions.
-91	Not Applicable – used to signify that a question did not apply to a respondent, usually due to routing.
-92	Refused – used to signify when a respondent has refused to answer a particular question.
-94	Insufficient Information – mainly used for derived variables and signifies

	that there is relevant information missing from source variables.
-95	Unable to classify – mainly used on variables assigned to code frames such as occupational classifications.
-96	MP/SP/YP unable to complete CASI section – used to signify that a respondent was unable to complete the self-completion section. This value label was also used to identify respondents who had used an interpreter.
-97	MP/SP/YP refused CASI section – used to signify that a respondent refused to answer the self completion section.
-98	MP/SP not present – used to signify that a respondent was not identified for this part of the questionnaire module (i.e. respondent was a single parent).
-99	MP/SP/YP not interviewed – used to signify that a respondent was identified as eligible to answer the relevant questionnaire modules but was not interviewed (this may be due to a number of reasons, i.e. not being available on the day the interview was conducted).
-996	No parent in household – used to signify where the Young Person is not living with any parent.
-997	Script error – data missing for question
-998	Interviewer missed question – used to signify item non-response due to interviewer/CAPI error.
-999	Missing household data – used to signify cases missing some household level information from the respondent.

For the purposes of this study, all of these were recoded to -99 for analysis.

No missing data analysis on the full database was carried out because according to the manual, the probability of responding over time could be modeled using certain demographic, socio-economic, and behavioral factors. Therefore, we already know that the missing data to

some extent was missing at random. That is, the missing data was related to some contextual variable that could be modeled[1].

Variables & Scales Examined

As stated above, a total of 123 variables were examined and taken from Waves 1 through 3. A detailed description of the variables and how they were used are outlined in this section in their respective tables. They are organized according to the type of information they represented or how they were used.

Demographic variables. Gender, Race, and student Free/Reduced lunch status served as demographic variables. Gender was a categorical variable coded 1 = males and 2 = females. Race was a categorical variable coded 1 = Caribbean, 2 = Mixed, 3 = Indian, 4 = Pakistani, 5 = Bangladeshi, 6 = White, 7 = African, and 8 = Other. These were re-coded into seven dichotomous dummy variables representing with the Caribbean group serving as the reference group. Whether or not the student was eligible to receive Free school meals was used as a proxy for student SES because this variable appears to be acknowledged by English researchers as an appropriate indicator of socioeconomic status (Cassen & Kindon, 2007). This variable was dichotomous with 1 = No and 2 = Yes. These variables were grand mean centered for analyses unless otherwise indicated.

Attitudinal/Behavioral variables and scales. There were six scales and two variables representing attitudes and behaviors examined in this study. These scales were Young Person's Attitude Towards School (12 ordinal items), Young People's Level of Risky behavior (11 dichotomous items), Young Person's Academic Self-Concept (5 ordinal items), Young Person's State of Mental Health (12 ordinal items), Young Person's Locus of Control (8 ordinal items), and Young Person's Perceived Discrimination in the Classroom (7 ordinal items). A detailed explanation on how these

[1] The reader should know that by default in MPLUS, missing data analyses was carried out when estimating the 2-PL unidimensional models for obtaining the IRT theta scores. The results are found in Table 5.

scales were created is provided further along in the methodology description under the *scale development* section. The scales used in this study were all standardized with a mean = 0 and standard deviation of 1.

The two variables representing parental attitudes and behaviors were Main Parent's Aspiration (nominal variable) and Main Parent's Expectation (nominal variable). The first variable, Main Parent's Aspiration, asked the main parent, "What would you like your child (young Person) to do once he/she reaches school leaving age?" The second variable asked the main parent, "What do you think your child (young Person) would do once he/she reaches school leaving age?" Both variables had the choice options of 1 = Continue in full time education, 2 = Start learning a trade/ Get a place on a training course, 3 = Start an apprenticeship, 4 = Get a full time paying job, and 5 = Something else. For this dissertation, it was important to examine parents behaviors and attitudes regarding higher education for their children, therefore, these five categories were collapsed into two, 0 = (Start an apprenticeship, Get a full time paying job, Something else) and 1 = (Continue in full time education, Start learning a trade/ Get a place on a training course). These variables were grand-mean centered for analysis.

Contextual variables. The variables Parent Involvement with School Life, Availability of Help with Homework at Home, and School Academic Ranking were selected as contextual variables to proxy parent academic support, the home academic environment, and the school academic environment. The variable "How involved do you personally feel with your child's (Young Person) school life?" was an ordinal variable ranging from 1 to 4 with, 1 = not involved at all, 2 = not very involved, 3 = fairly involved, and 4 = very involved. The variable "Does anyone at home help you with homework?" was a dichotomous variable with 1 = yes and 2 = no. The variable School Academic Ranking was derived by calculating the averaged total GCSE and equivalents new style point score for each school cluster and then standardizing this variable. (The GCSE and equivalents are exams taken at the end of the students 11^{th} year of formal schooling. These exams qualify students for advancing into tertiary education). Lower

averages were proxies for lower ranked schools, and conversely, higher averages were proxies for higher ranked schools. These variables were grand-mean centered for analyses purposes unless otherwise stated.

Outcome variables. There were two classes of outcome variables used in this study. The first were academic outcomes, and the second were attitudinal/behavioral outcomes.

Academic outcomes. The academic outcomes were standardized English, Mathematics, and Science fine graded point scores obtained at Key Stage 2 and Key Stage 3[2]. Key Stage 2 and 3 examinations are level-based; that is, lower scores are attributed to lower levels of the exams that are achieved, and similarly, higher scores are attributed to higher levels of the exams achieved. Fine graded point scores are calculated by taking into account levels of the examination achieved and the actual number of items correct at these levels. (A detailed description of how point scores and fine graded scores are calculated can be found in Appendix I, which is a document obtained from England's Department of Education website.) Similar to the English-speaking Caribbean, the level a student is allowed to take is primarily dictated by the classroom teacher.

Attitudinal/Behavioral Outcomes. The attitudinal and behavioral scales and items were also used as outcome variables in preliminary steps to examine the extent to which these differed by race. If these preliminary models revealed that there were no significant differences amongst the races for various attitudes and behaviors, then it was decided that there would be no need to include them in other predictive models explaining achievement.

Design weights and clusters

[2] Key Stage 2 exams are taken during the final year of primary schooling, when the students are aged 10/11. In approximation, then, Key Stage 2 appears to be equivalent to US & Caribbean grades 3 through 6. Likewise, Key Stage 3 appears to be equivalent to US & Caribbean grades 7 through 9. Similarly, Key Stage 3 exams are taken at the end of the 9th year of mandatory schooling.

Each Wave in the LSYPE database had a design weight accounting for disproportionate ethnic representation and the non-responders. Wave 4 also contained a panel weight that accounted for the longitudinal variables collected over the four time points. For the analyses that required growth curve modeling, the panel weight was used and for the analyses that required cross sectional modeling, their respective Wave weights were used.

The LSYPE database also provided a school level identifier for each student (SampPSU), thereby lending itself to hierarchical linear analysis. Preliminary analyses for fully unconditional random intercepts models were carried out on all outcome variables to verify the necessity of retaining random school cluster intercepts in the models. If these models demonstrated an intra-class correlation greater than .05, then random intercepts were retained, if not, the random intercepts were dropped.

Table 4 below provides a summary of the demographic, contextual, and outcome variables examined in this study. The table also provides the overall sample sizes of the Waves included in the study, the numbers of clusters present, and the name of the weights that were use.

Table 4

Descriptive summary of variables

	Wave 1		Wave 2		Wave 3	
	N	%	N	%	N	%
Sample Size	15770		13539		12439	
Clusters	647		647		647	
Weights	Weight_1		Weight_2		Weight_3 & Panel Weight	
Gender						
Male	7852	50.9%	6740	49.8%	6212	49.9%
Female	7579	49.1%	6577	48.6%	6082	48.9%
Missing	339	2.1%	222	1.6%	145	1.2%
Ethnicity						
Caribbean	596	3.8%	453	3.3%	NR	NR
Mixed	815	5.2%	670	4.9%	NR	NR
Indian	1019	6.5%	830	6.1%	NR	NR
Pakistani	963	6.1%	831	6.1%	NR	NR
Bangladeshi	743	4.7%	623	4.6%	NR	NR

White	10555	66.9%	9133	67.5%	NR	NR
African	624	4.0%	445	3.3%	NR	NR
Other	429	2.7%	313	2.3%	NR	NR
Total	15744	99.8%	13298	98.2%		
Missing	26	0.2%	241	1.8%		

	N	IQR	Min	Max	Mean	Median
Free school meal eligibility (binary)	12092		1	2	.179	
Parent Attitudes/Behaviors						
Parent Aspiration 1 (binary)	15178		0	1	.922	
Parent Aspiration 2 (binary)	13060		0	1	.905	
Parent Aspiration 3 (binary)	12133		0	1	.903	
Parent Expectation 1 (binary)	14554		0	1	.880	
Parent Expectation 2 (binary)	12571		0	1	.870	
Parent Expectation 3 (binary)	11974		0	1	.892	
Parent Involvement 1 (ordinal)	15454		1	4	2.91	3
Parent Involvement 2 (ordinal)	13345		1	4	2.98	3
Parent Involvement 3 (ordinal)	12267		1	4	3.05	3
Homework Help at Home (binary)	15098		0	1	.798	

	N	Range	Min	Max	Mean	Std Dev
Scales						
Attitude _ Wave 1	15195	6.41	-3.89	2.52	.067	.924
Attitude _Wave 2	13164	6.35	-3.64	2.71	.070	.914
Attitude _Wave 3	12189	6.15	-3.54	2.61	.087	.914
Risky Behavior _ Wave 1	15187	3.25	-.772	2.47	-.060	.773
Risky Behavior _ Wave 2	13155	3.38	-.947	2.43	-.089	.811
Risky Behavior _ Wave 3	12185	3.54	-1.09	2.46	-.113	.828
Academic Self Concept	15430	5.16	-1.92	3.24	-.048	.914

Perceived Discrimination	13134	5.52	-2.01	3.51	-.058	.830
Mental Health	13134	5.98	-2.25	3.72	-.037	.939
Academic Outcomes						
KS2 Math	14424	21.0	15.0	36.0	26.4	4.90
KS2 English	14412	21.0	15.0	36.0	26.4	4.44
KS2 Science	14396	21.0	15.0	36.0	28.1	3.82
KS3 Math	14607	38.5	15.0	53.5	35.3	8.09
KS3 English	14370	26.1	21.0	47.1	33.0	6.18
KS3 Science	14475	32.9	15.0	47.9	32.7	6.88
School Rank	15767	682	0	682	370	

Note. NR indicates not reported in the database.

ANALYSIS

Scale development

The LSYPE user guide indicated that the database contained clusters of items intended to measure certain behaviors and attitudes held by the respondents, and that these items could be grouped together into scales. A literature search on the psychometric properties of these scales revealed no published material, therefore, confirmatory analyses followed by item analyses seemed necessary to provide evidence of their reliability and to determine the usefulness of the indicator items. For this dissertation, confirmatory analyses were conducted on 92 indicator items which represented six scales. The scales were: -

1. Young Person's Attitude Towards School (Waves 1,2,3)
2. Young Person's Risky Behavior (Waves 1,2,3)
3. Young Person's State of Mental Health (Wave 2)
4. Young Person's Perceived Discrimination in the Classroom (Wave 2)
5. Young Person's Academic Self- Concept (Wave 2)
6. Young Person's Locus of control (Wave 2)

In each of the descriptions below and throughout this paper the term "YP" is an abbreviation for Young Person.

Longitudinal Scales

Young Person's Attitude Towards school. There were 12 items the LSYPE user guide identified to measure the Young Person's Attitude Towards school. For these items, the students were asked to indicate their level of agreement with each of statements below. The options were Strongly Agree, Agree, Disagree, and Strongly Disagree. These items were presented at Waves 1, 2, and 3 and therefore represented a longitudinal scale.

1. YP: Feelings about school: I am happy when I am at school
2. YP: Feelings about school: School is a waste of time for me
3. YP: Feelings about school: School work is worth doing
4. YP: Feelings about school: Most of the time I don't want to go to school
5. YP: Feelings about school: People think my school is a good school
6. YP: Feelings about school: On the whole I like being at school
7. YP: Feelings about school: I work as hard as I can in school
8. YP: Feelings about school: In a lesson, I often count the minutes till it ends
9. YP: Feelings about school: I am bored in lessons
10. YP: Feelings about school: The work I do in lessons is a waste of time
11. YP: Feelings about school: The work I do in lessons is interesting to me
12. YP: Feelings about school: I get good marks for my work

Students' responses for this scale were re-coded in a manner to represent "Positive attitude Towards school". Therefore, items 2,4,8,9,10 were coded so that "Strongly Agree" to "Strongly Disagree" got a 1 to 4 respectively, Conversely, items 1,3,5,6,7,11,12 were coded so that " Strongly Agree" to "Strongly Disagree" got a 4 to 1 respectively.

***Young Person Risky Behavior*.** There were 8 items the LSYPE user guide identified to measure the Young Person's level of Risky Behavior. Students were asked to indicate whether or not ("yes" or "no") they had ever engaged in the following types of behavior. These items were presented at Waves 1, 2, and 3, and therefore represented a longitudinal scale.

1. YP: Whether played truant in last 12 months
2. YP: Whether ever smoke cigarettes
3. YP: Whether ever had proper alcoholic drink

4. YP: Whether ever tried Cannabis
5. YP: Whether graffittied on walls in the last year
6. YP: Whether vandalised public property in the last year
7. YP: Whether shoplifted in the last year
8. YP: Whether taken part in fighting or public disturbance in the last year

The items for this scale were coded in a manner to represent "Risky Behavior Present". Therefore, for all items, Yes =1 and No = 0.

Cross-sectional scales

Academic Self Concept. There were 5 items the LSYPE user guide identified to measure Young Person Academic Self Concept. For the first two items, the Young Person was asked to indicate their level of agreement on a 5 point scale (Very Good, Above average, Average, Below average, Not at all good) and for the last 3 statements, the young Person was asked to indicate their level of agreement on a 4 point scale (Very Good, Fairly Good, Not Very Good, No Good At All).

1. YP: How good YP thinks YP is at school work
2. YP: How good teachers think YP is at school work
3. YP: How good or bad at this subject: Math
4. YP: How good or bad at this subject: English
5. YP: How good or bad at this subject: Science

The items were originally coded in the direction of Negative Academic Self concept, with higher scores on this scale indicating the student had more of a Negative perception of their academic abilities. Since the original responses to the items were uni-directional, there was no need to recode this scale.

Young Person Perceived Discrimination. There were 14 categorical items that the LSYPE user guide identified to measure the Young Person's Perceived Discrimination. At face value, these items seem to represent two types of discrimination, *discrimination based on race and religion* (7 items), and *discrimination experienced inside the classroom that was not related to race or religion* (7 items). Only items related to *discrimination experienced inside the classroom not related to race or religion* were analyzed in this study because Caribbean studies only looked at Discrimination experienced inside the classroom. To provide evidence that these 14 items did indeed load onto separate scales, exploratory factor analysis (EFA) was conducted on this scale. The choice options for these items did not appear to have a distinct ordinal nature, therefore they were left as is, and it was decided to recode if the reliability analyses results indicated that this was necessary. For example, if the reliability analyses results revealed that some items had moderate to high negative correlation with the scale, then this would suggest that these items ought to be reversed.

The EFA was carried out in SPSS version 19 using a random sample of half the students. The EFA procedures as suggested by Costello & Osborne (2005) included a principal axis extraction method because the assumption of multivariate normality was not met, an orthogonal varimax rotation for ease of interpretation, and the application of scree plot analysis in triangulation with theory (based on the LSYPE user guide) and the standard eigenvalue greater than one rule to identify and extract the factors. The maximum number of iterations for *extraction convergence* and iterations for *rotation convergence* was left at their defaults of 25.

During the first attempt of EFA, SPSS gave an error message and indicated that it was necessary to drop item 12 and 14 due to their invariability in responses and low response rates. Hence these items were dropped and the EFA was attempted again. The eigenvalues for this round of EFA suggested that the remaining 12 items loaded .3 or higher onto 4 separate scales: discrimination based on religion (items 9, 10, 11, 14); heavy punishment (items 4,5,8); teacher's praise and interest (items 6 and 7); and unfair treatment (items 2,3 and 8). Item 1 loaded negatively on the last factor. In contrast, the scree test suggested there were only 2 factors present.

Following the first EFA, reliability analysis was conducted on the 14 item scale. The overall reliability of this 14 item scale was .692. Items 11 and 12 had zero correlation with the scale indicating that they did not contribute to the measure. Item 1 had a moderate negative correlation of r = -.454 suggesting that it hurt the scale and needed to be recoded or dropped. The results for Cronbach's alpha if item deleted indicated that if item 1 was removed, Cronbach's alpha for the scale would increase to .800. It was decided to drop item 1, and re-run the EFA but constraining it to extract 2 factors.

The second round of EFA converged in just 3 rotations with items 2,3,4,5,6,7 and 8 loading onto the first factor called *discrimination in the classroom*, and items 9, 10, 11, and 13 loading onto the second factor called *discrimination based on ethnicity and religion*. The results of the second round of reliability analysis with just items 2,3,4,5,6,7 and 8 resulted in a Cronbach's alpha of .733. Thus it was decided to retain this adjusted scale and only use items 2 through 8 for Perceived Discrimination in the classroom.

1. YP: How many teachers this applies to: My teachers treat everyone the same regardless of skin colour or cultural background
2. YP: How many teachers this applies to: My teachers don't really listen to what I say in class.
3. YP: How many teachers this applies to: I get treated unfairly by my teachers
4. YP: How likely YP is to get punished if caught breaking school rules, compared with others
5. YP: How heavily YP gets punished for breaking school rules, compared with others
6. YP: How much interest teachers take in YP's work, compared with others
7. YP: How likely YP is to receive praise, compared with others
8. YP: How likely teachers are to blame YP if there is trouble in class, compared with others

9. YP: Whether YP thinks ever been treated unfairly by teachers because of skin colour or ethnic origin
10. YP: Whether YP thinks ever been treated unfairly by teachers because of religion
11. YP: Whether YP thinks that skin colour, ethnic origin or religion would make it more difficult to get on in education after Year 11
12. YP: How much more difficult YP thinks religion, ethnic origin or skin colour would make it to get on in education
13. YP: Whether YP thinks skin colour, ethnic origin or religion will make it more difficult for them to get a job after leave education
14. YP: How much more difficult YP thinks religion, ethnic origin or skin colour would make it to get a job

The choice options for items 2 and 3 were on a 5 point scale. These options were "All of my teachers", "Most of my teachers", "Some of my teachers", "Hardly any of my teachers" and "None of my teachers". The choice options for the items 4, and 5 were on a 4 point scale. These options were "More than others", "Less than Others" "Treated the Same", and "I never break the school rules". The choice options for items 6, 7, and 8 were on a 3 point scale. These options were "More than others", "Less than others" and Treated the Same". Higher numbers corresponded to being treated the same or I never break the rules, whereas lower numbers represented higher perceptions of discrimination. Since the reliability analysis showed that all of the items were positively correlated with the scale, it was decided that there was no need to recode any items.

***Young Person State of Mental Health*.** There were 12 items that the LSYPE user guide identified to measure Young Person's state of Mental Health. For each item, the Young Person was asked to express the degree to which they felt that emotion or state of being recently. All choices were on a 4 point scale, and in a manner of which higher points for each item corresponded with poorer health. Although the choices for each item were not identical, they did follow a similar pattern. For example, choices for items 1 and

12 were “More so than usual”, “Same as usual”, “Less so than usual”, “Much less than usual”. Choices for item 9 were “Not at all”, “No more than usual”, “Rather more than usual”, “Much more than usual”. Since the original responses to the items were uni-directional, there was no need to recode this scale.

1. YP: YP's recent concentration levels
2. YP: Whether YP has recently lost much sleep over worry
3. YP: How useful YP has felt recently
4. YP: How capable of making decisions YP has felt recently
5. YP: How much constantly under strain YP has felt recently
6. YP: How much YP has felt couldn't overcome their difficulties recently
7. YP: How much YP has been able to enjoy normal day-to-day activities recently
8. YP: How YP has been able to face up to problems recently
9. YP: How much YP has been feeling unhappy and depressed recently
10. YP: How much YP has been losing confidence in themselves recently
11. YP: How much YP has been thinking of themselves as a worthless Person recently
12. YP: How much YP has been feeling reasonably happy recently

Locus of Control. There were 8 items that the LSYPE user guide identified to measure a Person’s locus of control. The young Person was asked to indicate their level of agreement on a 4 point scale (Strongly Agree = 1, Agree 2, Disagree = 3 and Strongly Disagree = 4) for each of the statements below.

1. YP: Statements about success: If someone is not a success in life, it is usually their own fault.
2. YP: Statements about success: Even if I do well at school, I'll have a hard time getting the right kind of job.
3. YP: Statements about success: Working hard at school now will help me get on later on in life.

4. YP: Statements about success: People like me don't have much of a chance in life.
5. YP: Statements about success: I can pretty much decide what will happen in my life.
6. YP: Statements about success: Doing well at school means a lot to me.
7. YP: Statements about success: How well you get on in this world is mostly a matter of luck.
8. YP: Statements about success: If you work hard at something you'll usually succeed.

It appeared debatable as to which direction these items could be recoded, therefore, they were left as is, and it was decided to allow the reliability analysis to suggest whether some of these items ought to be reversed coded.

Confirmatory factor analyses

Altogether ten attitudinal/behaviors scales were examined in this study. Since the LSYPE user guide manual suggested these scales, it was only necessary to conduct confirmatory factor analyses to gather evidence in support of their structure. Therefore, each scale was subjected to uni-dimensional 2 PL IRT model fit analyses. For the confirmatory 2 PL models, the models were estimated under restricted maximum likelihood using the entire sample. The model type was set equal to 'complex' due to the clusters and weights that were specified in the estimations. The models that confirmed the structure for Young Person's Risky Behavior at Waves 1, 2, and 3 can be called two parameter logistic models due to the binary nature of the indicators. The other six models that confirmed the structure for Young Person's Academic Self- Concept (Wave 1), Young Person's Attitude Towards School (Waves 1, 2 and 3), Young Person's Locus of Control, Young Person's State of Mental Health (Wave 2), and Young Person's Perceived Discrimination (Wave 2) can be referred to as Samejima's graded response models due to the ordinal nature of their indicators. Although the scales Young Person's

Attitude Towards School and Young Person's Risky Behavior represented longitudinal scales and could have been estimated in MPLUS as such, they were nevertheless treated as separate scales at each time point to assess their degree of measurement invariance over time. The IRT theta scores were obtained using the Bayesian Expected A Posteriori approach.

Reliability Analysis

Following the confirmatory studies, reliability analyses were conducted in SPSS 19 on the scales to assess the extent of internal consistency of each of the scales. Cronbach's alpha along with the total item correlations are reported in Tables 7 through 16.

Preliminary Graphs on Longitudinal Outcome variables

Descriptive plots on each longitudinal outcome variable were created to gather evidence about the time and race effect. Plots of random intercepts are also presented here to demonstrate the necessity of including individual level intercepts into the models. Given the cluster nature of the LSYPE data, the necessity of retaining random intercepts in these models were tested with fully unconditional models. Although modeling individual random slopes could have been tested for these models as well, the priority for this study was given to the fixed effects, therefore random slopes were not considered.

Testing the necessity of modeling School level intercepts

The LSYPE database represented nested data with students clustered inside schools. Before addressing each research question outlined below, their fully unconditional random intercepts models were run to determine the necessity of retaining random intercepts for schools in the models. It was decided *a priori* that if the intra-class

correlation was less than .05, the school level would be dropped. Table 18 contains the results of the fully unconditional models that were examined.

Research Questions & Model Design Specifications

Research Question 1

How do students of Caribbean descent compare to students of other ethnic groups on identified factors related to academic achievement?

Longitudinal factors were addressed with Question 1.1 and cross-sectional factors were addressed with Question 1.2.

Longitudinal.

Question 1.1. What is the nature of the growth curves for each ethnic group for the following outcomes variables of interest?

1. Young Person's Attitude Towards School (theta scores)
2. Young Person's Risky Behavior (theta scores)
3. Parental expectations (dichotomized item)
4. Parental aspirations (dichotomized item)
5. Parental Involvement with young Person's school progress (one ordinal item)

Three Level Models

(For linear models that retained that random school level intercepts).

Full Model:

$Y_{ijk} = (\gamma_{000} + \mu_{00k} + b_{0jk}) + \pi_1 Year_{ijk} + (\pi_2 Race_{1ij} \ldots \pi_8 Race_{8ij}) + (\pi_9 Race_{1ij} Year_{ijk} \ldots \pi_{15} Race_{7ij} Year_{ijk}) + e_{ijk}$

i= scores within a person

j = individuals

k = schools

γ_{000} = overall grand mean

μ_{00k} = random component for school intercepts

b_{0jk} = random component for individual level intercepts

π = Beta coefficients indicating that this is a 3 level model

Two Level Models

(For models that did not retain the random school level intercepts).

Full Linear Model:

$Y_{ij} = (\gamma_{00} + b_{0i}) + \beta_1 Year_{ij} + (\beta_2 Race_{1i} \ldots \beta_8 Race_{8i}) + (\beta_9 Race_{1i} Year_{ij} \ldots \beta_{15} Race_{7i} Year_{ij}) + e_{ij}$

i= individuals

j = time

γ_{00} = overall grand mean

b_{0i} = random component for individual level intercepts

Ordinal Regression:

$$\log\left[\frac{P(Involvement_{ij} > c | b_{oi})}{1 - P(Involvment_{ij} > c | b_{oi})}\right] = \alpha_c + \beta_1 Time_{ij} + \beta_2 Race_i \ldots \beta_8 Race_i + \beta_9 Time_{ij} * Race_i \ldots . \beta_{15} Time_{ij} * Race_i + b_{oi}$$

Logistic Regression:

$$\text{Log}\left[\frac{P(Expec/Aspir_{ij}=1|b_{01})}{1-P(Expec/Aspir_{ij}=1|b_{01})}\right] = (\gamma_{00} + b_{0i}) + \beta_1 Year_{ij} + (\beta_{2i} Race_{1i} \ldots \beta_8 Race_{7i}) + (\beta_9 Race_{1i} Year_{ij} \ldots \beta_{15} Race_{7i} Year_{ij})$$

b_{0i} = random component for individual level intercepts

For the growth curve models, time points were nested inside individuals. Individuals were also nested inside schools if the unconditional models demonstrated that a third level ought to be modeled. Both second and third level intercepts were allowed to randomly vary. These growth curve models were conducted in R 2.10.1 using the lmer function in the lme4 package under full maximum likelihood for the continuous theta scores; clmm in the ordgee package for the ordinal outcome variable[3], and lmer for the dichotomized outcome variables with a logit transformation and an adaptive Gaussian Hermite quadrature set to 10. [4]

Cross-sectional

Question 1.2. How do the different ethnic groups compare on each of the attitudes/behaviors outlined below:-

1. Young Person's Academic Self Concept (theta scores)
2. Young Person's Perceived Discrimination (theta scores)
3. Young Person's State of Mental Health (theta scores)

[3] The clmm package was used after verifying that the assumption of parallel lines was tenable. The parallel lines assumption was checked by first creating three splits for the ordinal outcome variable, followed by an examination of the intercepts and slopes of the splits using individual logistic regressions (by employing the geeglm function and an exchangeable correlation matrix) and finally comparing these coefficients to the ones suggested by the ordgee package (under an exchangeable correlation matrix).

[4] Only linear growth curve models were explored due to the fact that there were only three time points, thus rendering any other type of growth curve, except for fractional polynomials, inappropriate. Fractional polynomials were not considered here because neither the descriptive plots nor previous research suggest that this degree of complexity in the growth curves was necessary.

Full model:

(Linear models in which random intercepts for school clusters were retained).

$Y_{ij} = (\gamma_{00} + u_{0j}) + (\gamma_{10}Race_{1ij} \ \ldots \ \gamma_{70}Race_{7ij}) + r_{ij}$

i = Persons

j = schools

γ_{00} = overall grand mean

u_{0j} = random component for school clusters

Full model:

(Linear models in which random intercepts were not retained).

$Y_i = \beta_0 + \beta_1 Race_{1i} \ \ldots \ \beta_7 Race_{7i} + r_i$

For these cross-sectional models, individuals were nested inside schools. The models were fit under full maximum likelihood using lmer in the lme4 package in R.

Research Question 2

Is there an achievement gap between boys and girls of Caribbean descent who reside outside of the Caribbean? If so, how does this gap compare to the general population?

This question was addressed with Questions 2.1 and 2.2 below.

Question 2.1. Is there a Sex effect amongst Caribbean students at both time points? How does this compare when looking at the students as a whole, and then students in their specific ethnic groups?

Independent samples *t*-test examining differences between girls and boys in all three content areas at both time points, KS2 and KS3, were conducted. These *t*-tests were performed on a) the entire sample, and then b) on the seven ethnic groups to determine the extent to which students patterns of performance were similar or different.

Question 2.2. Parallel Analyses: Do Caribbean boys make more, less, or equal progress than Caribbean girls in achievement between Key Stage 2 and Key Stage 3? If so, how does the progress of Caribbean boys and girls compare to the progress of boys and girls in different ethnic groups.

In order to compare the size of the Sex effect on students' academic progress amongst individuals of the same ethnic group, parallel regressions were carried out as outlined below. KS2 scores were included as a covariate for prior knowledge.

For these parallel analyses, there were small numbers of individuals in each cluster for the different ethnic groups (many with n = 1), thus oftentimes there was a lack in variability with gender and also achievement. Therefore, random intercepts for school clusters were not included for parallel regressions except for the White group. The design effect for the models representing the different ethnic groups were calculated to demonstrate how much the standard errors would have been impacted had school intercepts been included in the models. The design effects for the models were calculated as follows:

Design Effect = $1 + d\ (n - 1)$

- d is the intraclass correlation for the statistic in question, and ,
- n is the average size of the cluster

$KS3_i = \beta_0 + \beta_1 KS2_i + \beta_2 Sex_i + r_i$

These models were examined in R via multiple linear regression using the LME4 package in R.

Research Question 3

What types of schools, if any, may ameliorate the achievement gap between boys and girls of Caribbean descent?

This question was addressed by first examining whether certain schools were more equitable in their gender-achievement relationship followed by identifying the schools in which the average boys' achievement was at least one standard deviation above the grand average achievement for boys. By cross-referencing both sets of schools in each category, it was possible to identify schools that overlap and thereby pinpoint ones that not only may be more equitable but also ones that boys actually do well in. These then perhaps might be ones that level the field between girls and boys of Caribbean descent.

Explanation of Equitable Schools. In order to determine whether or not some schools were more equitable, it was necessary to examine whether the gender effect was consistent across the schools. To do this, random coefficient models were explored by allowing the school level intercepts as well as the level 1 slopes for sex (β_2Sex) to randomly vary. If the results for these models demonstrate that there was statistically significant variation in the level 1 sex slopes coupled with evidence from the deviance test suggesting that the random component for sex slopes ought to be retained; this then would provide evidence that there is variation in the gender effect and perhaps there might be some schools in which this effect is not as pronounced.

If indeed there was enough evidence to suggest that sex slopes differed amongst the schools, sex slopes would be ranked in ascending order in terms of the size and direction of their slopes. Schools that have negative slopes would be said to favor boys, and schools with positive slopes would be said to favor girls. Schools that have slopes closer to zero would be deemed more equitable in their gender-achievement relationship. These equitable schools would be further examined to determine whether any of them

were ones in which the boys average were at least one standard deviation above the mean boys achievement. This would suggest that these schools were not only equitable but that boys performed well there too.

Explanation of Contextual Effect. Some Caribbean studies suggested that girls and boys perform differently if they are in single-gender schools. Other studies suggest that the sex effect is moderated by the quality of the school. Thus, it was also of interest to examine whether there was a contextual effect of gender on achievement at the school level, and whether there was cross-level interaction between gender and School Rank.

To determine whether or not a contextual effect was present, school averages for gender were calculated (that is, the proportion of females in the cluster) and used as a predictor of level 2 intercepts (γ_{01}AveSex). If there was a contextual effect for gender, then the level 2 predictor γ_{01}AveSEX would still be significant even after controlling for gender at level 1.

The cross-level interaction term of gender and School Rank was the second contextual effect to be examined. This was entered in the full model to determine whether School Rank was a significant predictor of level 1 sex slopes. If so, then this would provide evidence that similar to Caribbean findings, School Rank does moderate the relationship between sex and achievement (Kutnich, 1999; Lisle et al 2005).

Thus, the following full model was examined to address the variation in the sex slopes (to determine whether some were more equitable in the gender-achievement relationship), the contextual effect, and cross-level interaction term posed for Research Question 3:-

Question 3.1. Which schools are more equitable? Is there a contextual effect for gender? Is there a cross-level interaction between gender and School Rank?

Level-1 Model

$$KS3_{ij} = \beta_{0j} + \beta_{1j}KS2_{ij} + \beta_{2j}SEX_{ij} + r_{ij}$$

Level-2 Model

$\beta_{0j} = \gamma_{00} + \gamma_{01}(\text{Sex\_Mean})_j + \gamma_{02}(\text{KS2\_Mean})_j + u_{0j}$

$\beta_{1j} = \gamma_{10}$

$\beta_{2j} = \gamma_{20} + \gamma_{21}\text{School\_Rank}_j + u_{2j}$

Model comparisons were made using the deviance statistic to determine whether or not to retain the random component for sex slopes. Secondly, the random intercepts model below was also explored to identify schools in which the average boys' intercept was at least one standard deviation above the grand mean for boys in each content area.

Question 3.2. In which schools do boys progress at least one standard deviation above the boys' average progress? Only boys were included in this model.

$KS3_{ij} = \gamma_{00} + \mu_{0j} + \beta_{1j}KS2_{ij} + r_{ij}$

Are there any overlapping schools for equity and progress?

To answer this question, schools that had a sex slope of zero and above average boys performance (at least one standard deviation above the male average) were selected for further analyses.

For models 3.i group mean centering was used because group mean rather than grand mean centering is recommended for estimating random effects and contextual effects. Grand mean centering for model 3.ii was used because the goal was to estimate fixed effects (Raudenbush & Bryk (2002).

A limitation of the analyses for Research Question 3 was that the entire LSYPE database was used because the sample sizes of Caribbean students in each cluster were too small. A second limitation was that it was assumed that the proportion of females in each school cluster was representative of that school. Third, Research Question 3 was examined using HLM 7 due to the ease of obtaining beta coefficient estimates and necessary plots. HLM 6 and 7 do not allow the calculation of CHIPCT, MDIST,

LNTOTVAR, OLSRSVAR, MDSRVAR, and all the OLS residuals with the utilization of weights. Therefore, level 1weights were not employed and as a result the coefficient estimates were slightly off.

Research Questions 4

Question 4. Is the achievement gap between boys and girls of Caribbean descent moderated by any attitudinal or behavioral factors related to academic achievement?

To test KS3 math, science, and English exam scores multiple regression models were employed.

$$KS3_i = \beta_0 + \beta_1 KS2_i + \beta_2 SES_i + \beta_3 Sex_i + \beta_4 Academic\_Self\_Concept_i + \beta_5 Parent\_Aspir_i + \beta_6 Parent\_Exp_i + \beta_7 ParentInvolvement1_i + \beta_8 ParentInvolvement2_i + \beta_9 ParentInvolvement3_i + \beta_{10} StudySupport_i + \beta_{11} Attitude_i + \beta_{12} MentalHealth_i + \beta_{13} RiskyBehavior_i + \beta_{14} Discrimination_i + \beta_{15} Academic\_Self\_Concept_i * Sex_i + \beta_{16} Parent\_Aspir_i * Sex_i + \beta_{17} Parent\_Exp_i * Sex_i + \beta_{18} ParentInvolvement1_i * Sex_i + \beta_{19} ParentInvolvement2_i * Sex_i + \beta_{20} ParentInvolvement3_i * Sex_i + \beta_{21} StudySupport_i * Sex_i + \beta_{22} Attitude_i * Sex_i + \beta_{23} MentalHealth_i * Sex_i + \beta_{24} RiskyBehavior_i * Sex_i + \beta_{25} Discrimination_i * Sex_i + r_i$$

Single-level multiple regression models were examined in R. All data came from Wave 1 except for the theta scale scores for Young Person Mental Health and Young Person Perceived Discrimination. Full models were compared to reduced models to achieve the most parsimonious model.

Research Question 5

When controlling for school environment, are attitudinal and behaviors factors still important for predicting the achievement gap between boys and girls of Caribbean descent?

To address this question, final reduced models that were selected from Research Question 4 were modeled with the inclusion of School Rank (a proxy for school environment). The extent to which the inclusion of School Rank impacted the significance of the other predictors would help determine whether these attitudinal/behavioral factors were still important above and beyond the inclusion of School Rank.

The same analyses outlined for Research Questions 4 and 5 were performed on the white group, the majority group in England. These comparative analyses were conducted to determine the extent to which attitudes and behaviors important for predicting achievement amongst Caribbean students were also true for White students.

Due to the exploratory nature of this study, no family-wise error rate adjustments were made on alpha. For linear mixed models conducted in R,

CHAPTER IV: RESULTS

The Results section is divided into 2 main parts; Preliminary Analyses and Research Questions. Part I: Preliminary Analyses present the results for the Confirmatory analyses, Reliability analyses, Descriptive Plots, and Testing the Necessity of Random School Intercepts in that order. Part II: Research Questions presents the results for research questions 1 through 5.

Part I: Preliminary Analyses

Confirmatory Analyses

The factor structures for the two- parameter uni-dimensional IRT models were entered for estimation in MPLUS. The final models that were estimated are presented in Figures 1 through 6 below.

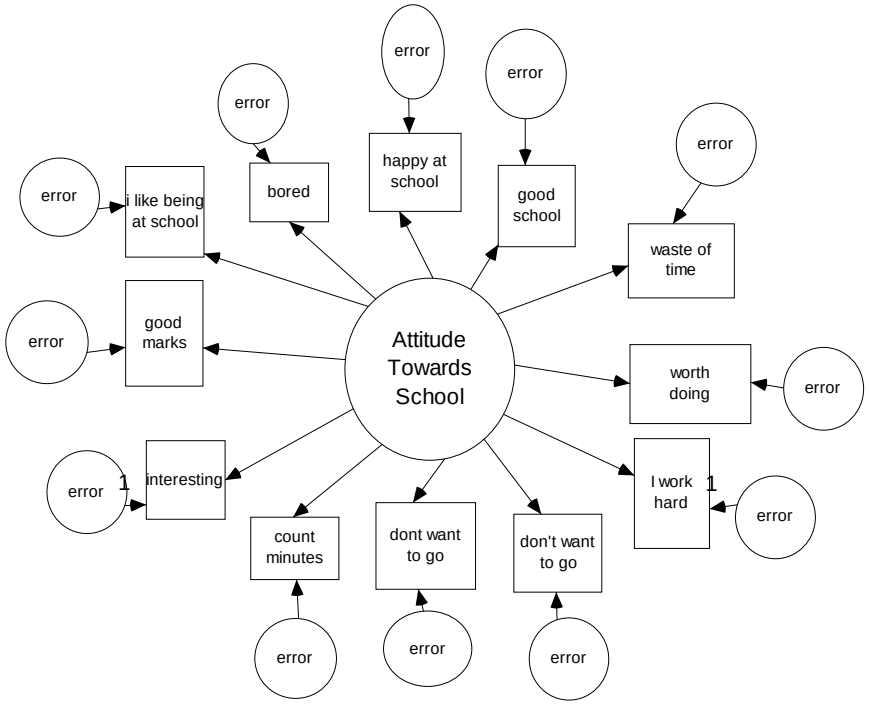


Figure 1. Young Person's Attitude Towards School

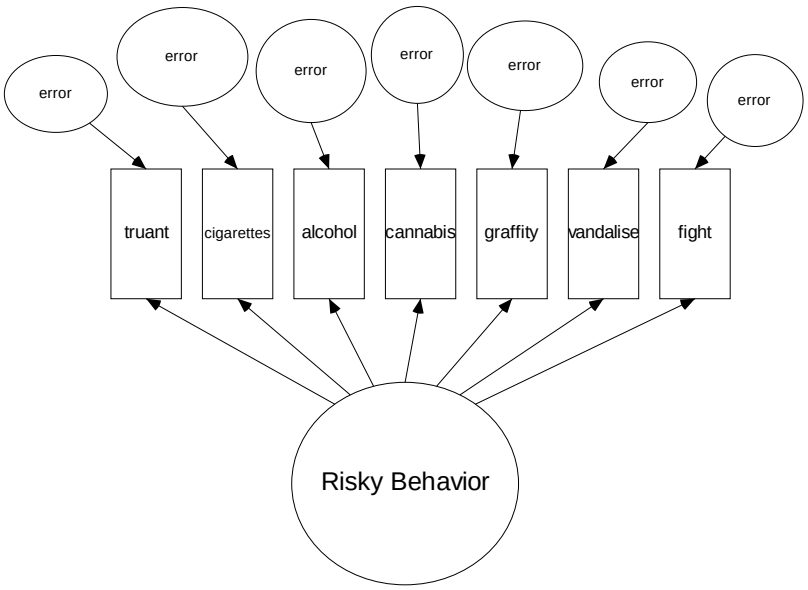


Figure 2. Young Person's Risky Behavior

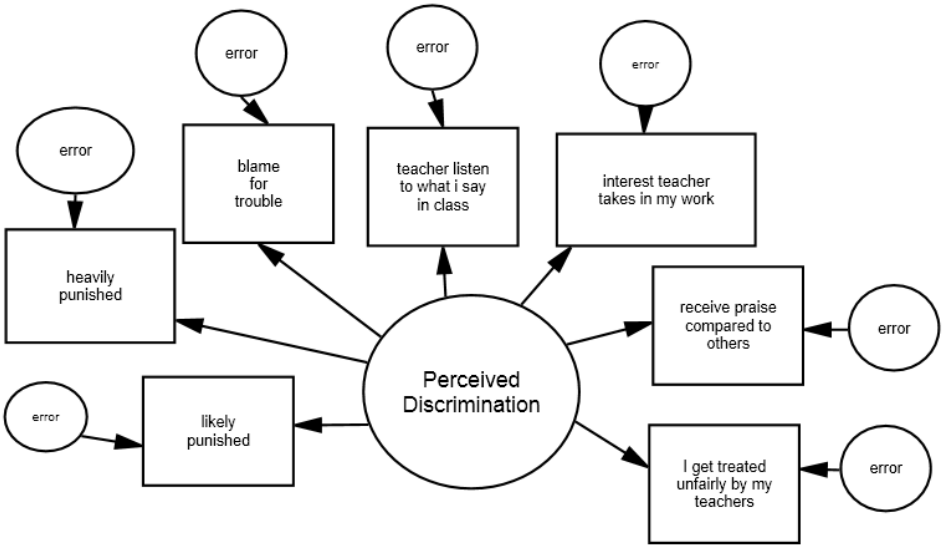


Figure 3. Young Person's Perceived Discrimination

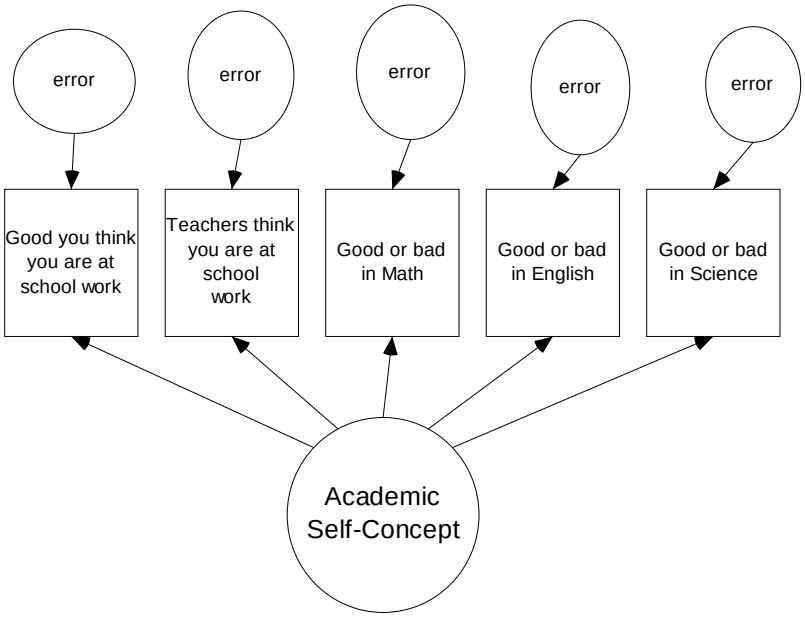


Figure 4. Young Person's Academic Self-Concept

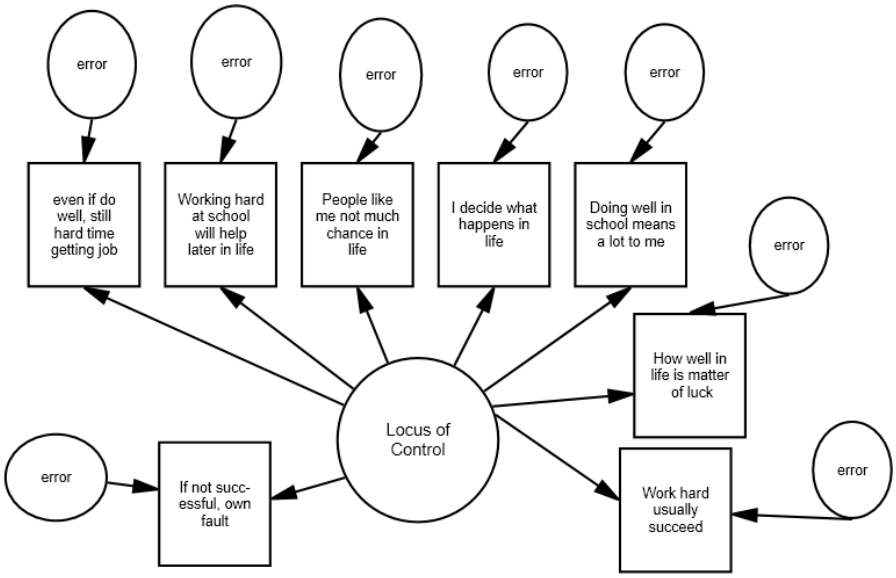


Figure 5. Young Person's Locus of Control

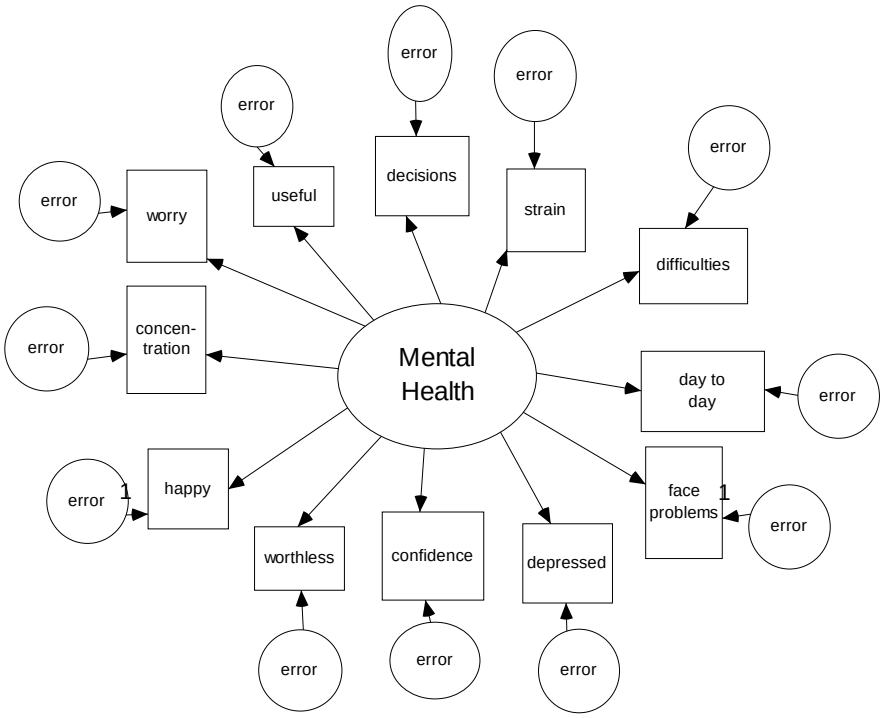


Figure 6. Young Person's State of Mental Health

IRT 2 PL Models

The model fit indices results for the 2 PL models on the full data set are presented in Table 5. For IRT analyses, MPLUS output provides the test of model fit by supplying estimates for the log likelihood and information criteria.

Table 5

Test of model fit estimates: Log likelihood, AIC, BIC, BIC adjusted, Pearson's chi-square test p-value for MCAR

	log.Lik	AIC	BIC	BIC adjusted	Pearson Chi-Square Test for MCAR (*p*-value)

Attitude Towards School_ Wave 1	-162040	324175.5	324541.7	324389.1	Could not be calculated*
Attitude Towards School_ Wave 2	-142029	284154.2	284513.5	284361	Could not be calculated*
Attitude Towards School_ Wave 3	-127948	255991.1	256346.7	256194.1	Could not be calculated*
Self-Concept	-73333.3	146710.6	146878.8	146808.9	1
Risky Behavior_ Wave 1	-40876.9	81785.8	81907.9	81857	0
Risky Behavior_ Wave 2	-38095.5	76223	76342.7	76291.9	0.252
Risky Behavior_ Wave 3	-35123.9	70279.7	70398.2	70347.4	0.6226
Poor Mental Health	-132611	265318.1	265677.3	265524.7	Could not be calculated*
Perceived Discrimination	-25399.4	50816.7	50883.9	50855.3	0
Perceived Discrimination	-82293.4	164640.8	164842.9	164757.1	1
Young Person's Locus of Control	-81605.1	163274.2	163508.7	163407	1

Note. * = The explanation provided in the output was that the chi-square test cannot be computed because the frequency table for the latent class indicator model part is too large.

Comparing 2 PL to 1PL models for Model Fit

Model fit comparisons were made in R using the latent trait modeling package to determine the extent to which 2 PL models were better model fits than 1 PL models. (The reader should note that R used marginal maximum likelihood to estimate the parameters, whereas MPLUS used restricted maximum likelihood, therefore the fit indices estimates are slightly different). These comparisons were made on the Attitude Towards School and Risky Behavior taken from Wave 1 because Wave 1 had the largest sample size. Academic Self Concept was also measured at Wave 1. Mental Health,

Perceived Discrimination and Locus of Control were assessed at Wave 2. The 2 PL models were compared to 1PL models l using the likelihood ratio test. The results in Table 6 demonstrate that that in all cases, the 2PL was a better model than the 1 PL.

Table 6

Model Comparison for Fit: 2 PL vs 1PL models

	AIC	BIC	log.Lik	LRT	Df	*p*.value
Attitude 1PL	328038.4	328322.0	-163982.2			
Attitude 2PL	324967.7	325335.6	-162435.8	3092.7	11	<.001
Risky 1PL	81088.45	81157.4	-40535.2			
Risky 2PL	80608.40	80731.1	-40288.20	494.04 7	7	<.001
Mental Health 1PL	269623.3	269907.0	-134774.7			
Mental Health 2PL	265905.2	266273.1	-132904.6	3740.2	11	<.001
Discrimination 1PL	51588.56	51642.2	-25787.3			
Discrimination 2PL	50855.61	50924.6	-25418.8	737.0	2	<.001
Self Concept 1PL	152438.1	152576.1	-76201.0			
Self Concept 2PL	147704.8	147873.4	-73830.4	4741.3	4	<.001
Locus of Control 1PL	165932.0	166093.0	-82945.0			
Locus of Control 2PL	165310.3	165517.3	-82628.2	633.7	6	<.001

Thus, it was reasonable to assume that Waves 1 through 3 had the following factors present:-

Wave 1: Young Person's Attitude Towards School (12 ordinal items)
Young Person's Risky Behavior (8 dichotomous items)
Young Person's Academic Self-Concept (5 ordinal items)

Wave 2: Young Person's Attitude Towards School (12 ordinal items)
Young Person's Risky Behavior (8 dichotomous items)
Young Person's State of Mental Health (12 ordinal items)
Young Person's Perceived Discrimination (7 ordinal items)
Young Person's Locus of Control (8 items)

Wave 3: Young Person's Attitude Towards School (12 ordinal items)
Young Person's Risky Behavior (8 dichotomous items).

Reliability Analysis

As a general rule of thumb, when conducting reliability analyses for scales, it is common to use reliability evidence of at least alpha = .7 to make research decisions, .8 for group level decisions, and .9 for individual level decisions (George & Mallery, 2003). The results of the reliability analyses demonstrated that all of the scales had a Cronbach's alpha measure of reliability of at least .7, with the exception of the scale for Young Person Locus of Control. That scale had a Cronbach's alpha of .356, therefore it was decided to not include it in further analysis. Tables 7 through 9 display the reliability evidence for Wave 1, Tables 10 through 14 display the reliability evidence for Wave 2, and Tables 15 and 16 display the reliability evidence for Wave 3.

Table 7

Young Person's Attitude Towards School Wave 1: Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Cronbach's alpha = .831				
YP: Feelings about school: I am happy when I am at school	33.91	22.69	.53	.82
YP: Feelings about school: School is a waste of time for me	33.53	23.10	.47	.82
YP: Feelings about school: School work is worth doing	33.63	23.43	.40	.83
YP: Feelings about school: Most of the time I don't want to go to school	34.19	21.38	.57	.81
YP: Feelings about school: People think my school is a good school	34.15	23.42	.31	.84
YP: Feelings about school: On the whole I like being at school	33.93	22.07	.63	.81
YP: Feelings about school: I work as hard as I can in school	33.91	22.91	.47	.82
YP: Feelings about school: In a lesson, I often count the minutes till it ends	34.59	22.31	.44	.82
YP: Feelings about school: I am bored in lessons	34.45	21.52	.62	.81

YP: Feelings about school: The work I do in lessons is a waste of time	33.76	22.68	.53	.82
YP: Feelings about school: The work I do in lessons is interesting to me	34.10	22.73	.57	.81
YP: Feelings about school: I get good marks for my work	33.92	24.07	.39	.83

Note. N = 11783

Table 8

Young Person's Risky Behavior Wave 1: Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Cronbach's alpha = .725				
YP: Whether played truant in last 12 months	1.07	1.93	.46	.69
YP: Whether ever smoke cigarettes	1.12	2.02	.48	.69
YP: Whether ever had proper alcoholic drink	0.76	1.83	.32	.74
YP: Whether ever tried Cannabis	1.13	2.05	.48	.69
YP: Whether ever graffittied on walls	1.16	2.17	.41	.70
YP: Whether ever vandalized public property	1.12	2.03	.47	.69
YP: Whether ever shoplifted	1.10	2.02	.44	.69
YP: Whether ever taken part in fighting or public disturbance	1.04	1.91	.44	.69

Note. N = 13010.

Table 9

Young Person's Academic Self Concept Wave 1: Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Cronbach's alpha = .716				
YP: How good YP thinks YP is at school work	8.08	3.58	.68	.57
YP: How good teachers think YP is at school work	8.06	3.65	.64	.59

YP: How good or bad at this subject: Math	8.34	4.83	.37	.71
YP: How good or bad at this subject: English	8.34	4.91	.34	.72
YP: How good or bad at this subject: Science	8.33	4.72	.36	.71

Note. N = 14881.

Table 10

Young Person's Attitude Towards School Wave 2: Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Cronbach's alpha = .836				
YP: Feelings about school: I am happy when I am at school	32.81	23.56	.55	.82
YP: Feelings about school: School is a waste of time for me	32.44	23.78	.51	.82
YP: Feelings about school: School work is worth doing	32.61	24.41	.35	.84
YP: Feelings about school: Most of the time I don't want to go to school	33.01	22.39	.58	.82
YP: Feelings about school: People think my school is a good school	33.04	24.61	.31	.84
YP: Feelings about school: On the whole I like being at school	32.84	23.02	.65	.81
YP: Feelings about school: I work as hard as I can in school	32.88	23.86	.49	.82
YP: Feelings about school: In a lesson, I often count the minutes till it ends	33.47	23.54	.45	.82
YP: Feelings about school: I am bored in lessons	33.33	22.70	.63	.81
YP: Feelings about school: The work I do in lessons is a waste of time	32.65	23.73	.54	.82
YP: Feelings about school: The work I do in lessons is interesting to me	33.03	23.91	.56	.82
YP: Feelings about school: I get good marks for my work	32.85	25.12	.41	.83

Note. N = 9790

Table 11

Young Person's Risky Behavior Wave 2: Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Cronbach's alpha = .722				
YP: Whether YP played truant in last 12 months	1.46	2.06	.49	.68
YP: Whether YP ever smokes cigarettes	1.47	2.05	.51	.67
YP: Whether YP ever had proper alcoholic drink	1.03	2.19	.32	.73
YP: Whether YP ever tried Cannabis	1.46	1.99	.56	.66
YP: Whether graffitied on walls in the last year?	1.67	2.61	.32	.72
YP: Whether vandalised public property in the last year?	1.64	2.47	.42	.70
YP: Whether shoplifted in the last year?	1.64	2.49	.37	.71
YP: Whether taken part in fighting or public disturbance in the last year?	1.56	2.27	.43	.69

Note. N = 11150

Table 12

Young Person's State of Mental Health Wave 2: Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Cronbach's alpha = .751				
YP: YP's recent concentration levels	30.79	16.39	.44	.73
YP: Whether YP has recently lost much sleep over worry	30.54	14.61	.54	.71
YP: How useful YP has felt recently	30.70	16.81	.36	.74
YP: How capable of making decisions YP has felt recently	30.53	17.05	.32	.74
YP: How much constantly under strain YP has felt recently	30.74	14.06	.58	.71
YP: How much YP has felt couldn't overcome their difficulties recently	30.61	14.16	.61	.70

YP: How much YP has been able to enjoy normal day-to-day activities recently	30.68	16.18	.46	.73
YP: How YP has been able to face up to problems recently	30.61	16.42	.42	.73
YP: How much YP has been losing confidence in themselves recently	30.46	13.95	.64	.70
YP: How much YP has been thinking of themselves as a worthless Person recently	30.25	14.72	.58	.71
YP: How much YP has been feeling reasonably happy recently	31.92	21.77	-.54	.83

Note. N = 10,266

Table 13

Young Person's Perceived Discrimination Wave 2: Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Cronbach's alpha = .733				
YP: How many teachers this applies to: My teachers don't really listen to what I say in class.	16.89	9.99	.31	.75
YP: How many teachers this applies to: I get treated unfairly by my teachers	16.39	9.45	.48	.69
YP: How likely YP is to get punished if caught breaking school rules, compared with others	18.02	9.87	.53	.68
YP: How heavily YP gets punished for breaking school rules, compared with others	17.79	10.15	.54	.68
YP: How much interest teachers take in YP's work, compared with others	17.89	10.84	.40	.71
YP: How likely YP is to receive praise, compared with others	17.82	10.89	.45	.71
YP: How likely teachers are to blame YP if there is trouble in class, compared with others	17.98	10.30	.50	.69

Note. N = 9135

Table 14

Locus of Control Wave 2: Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Cronbach's alpha = .356				
YP: Statements about success: If someone is not a success in life, it is usually their own fault.	15.82	4.53	.21	.29
YP: Statements about success: Even if I do well at school, I'll have a hard time getting the right kind of job	15.43	4.95	.08	.36
YP: Statements about success: Working hard at school now will help me get on later on in life.	16.54	4.90	.20	.30
YP: Statements about success: People like me don't have much of a chance in life.	14.72	5.10	.05	.37
YP: Statements about success: I can pretty much decide what will happen in my life.	15.83	4.72	.14	.33
YP: Statements about success: Doing well at school means a lot to me.	16.42	4.81	.20	.30
YP: Statements about success: How well you get on in this world is mostly a matter of luck.	15.09	4.83	.11	.35
YP: Statements about success: If you work hard at something you'll usually succeed.	16.38	4.89	.21	.30

Note. N = 9122

Table 15

Young Person's Attitude Towards School: Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Cronbach's alpha = .862				
YP: Feelings about school: I am happy when I am at school	33.20	25.59	.63	.85
YP: Feelings about school: School is a waste of time for me	32.82	26.04	.57	.85
YP: Feelings about school: School work is worth doing	32.97	26.87	.38	.86

YP: Feelings about school: Most of the time I don't want to go to school	33.38	24.55	.63	.85
YP: Feelings about school: People think my school is a good school	33.40	26.96	.35	.87
YP: Feelings about school: On the whole I like being at school	33.20	25.19	.68	.84
YP: Feelings about school: I work as hard as I can in school	33.31	26.35	.52	.85
YP: Feelings about school: In a lesson, I often count the minutes till it ends	33.84	25.75	.52	.85
YP: Feelings about school: I am bored in lessons	33.74	25.08	.66	.84
YP: Feelings about school: The work I do in lessons is a waste of time	33.08	26.19	.56	.85
YP: Feelings about school: The work I do in lessons is interesting to me	33.48	26.33	.58	.85
YP: Feelings about school: I get good marks for my work	33.26	27.55	.46	.86

Note. N= 9742

Table 16

Young Person's Risky Behavior: Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Cronbach's alpha = .722				
YP: Whether YP played truant in last 12 months	1.46	2.06	.49	.68
YP: Whether YP ever smokes cigarettes	1.47	2.05	.51	.67
YP: Whether YP ever had proper alcoholic drink	1.03	2.19	.32	.73
YP: Whether YP ever tried Cannabis	1.46	1.99	.56	.66
YP: Whether graffitied on walls in the last year?	1.67	2.61	.32	.72
YP: Whether vandalised public property in the last year?	1.64	2.47	.42	.70
YP: Whether shoplifted in the last year?	1.64	2.49	.37	.71
YP: Whether taken part in fighting or public disturbance in the last year?	1.56	2.27	.43	.69

Note. N = 11150

Descriptive Plots

Figure 7 is a plot of thirty randomly selected students Attitude Towards School over the three time points. There does appear to be a need to model random intercepts and slopes, however the majority of the slopes appear to be slightly deceasing over time.

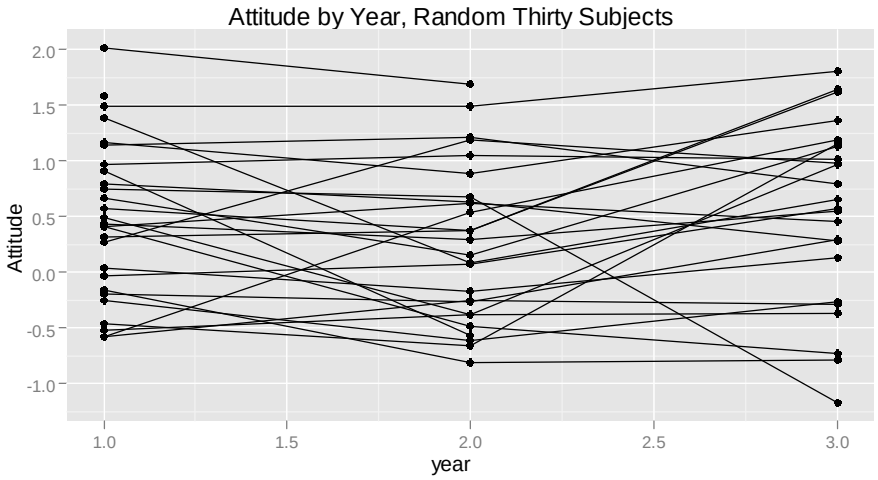


Figure 7. Young Person Attitude Towards School over Time (N = 30).

Note. Thirty subjects were randomly selected for this plot. Not all had 3 time points

Figure 8 is a linear plot of Young People's Attitude Over Time By Race. Here there appears to be a race affect, however only some of the races appear different from others. Also, the majority of the growth curves appeared relatively flat. Significance testing in further analyses revealed more conclusive answers.

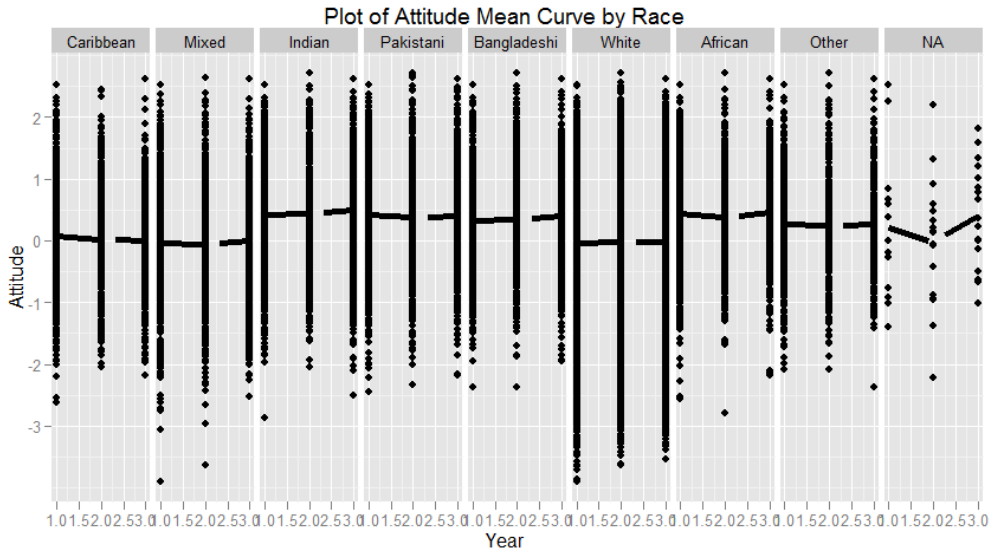


Figure 8. Young Person Attitude Towards School over Time by Race

Figure 9 below is a plot of a random sample of thirty students' Risky Behavior over the three time points. Again, there appears to be a necessity for random intercepts and slopes. The figure also shows that half the slopes appear to increase and the other half appear to decrease, so perhaps there is an overall null effect of time over the three years. Figure 10 is also a plot of Young Person Risky Behavior over time but by Race.

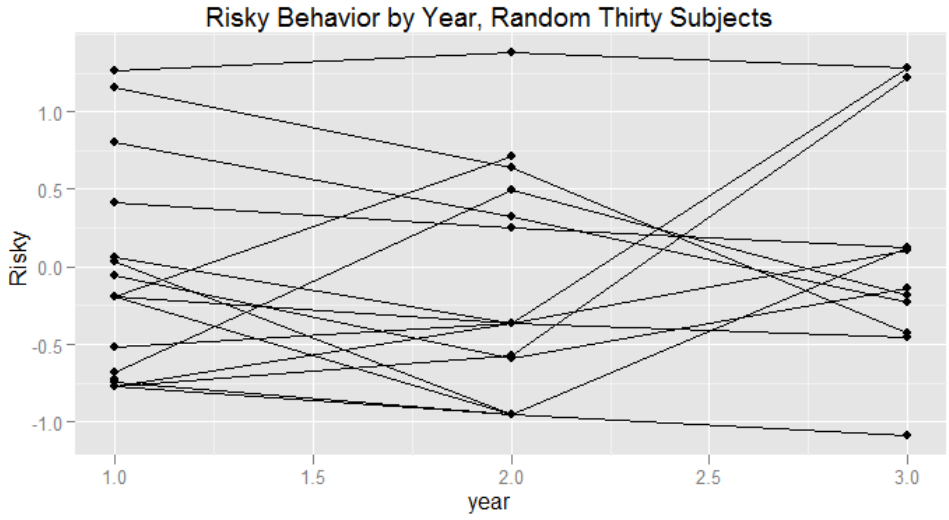


Figure 9. Young Person Risky Behavior over Time (N = 30)

Note. Some individuals had less than 3 data points

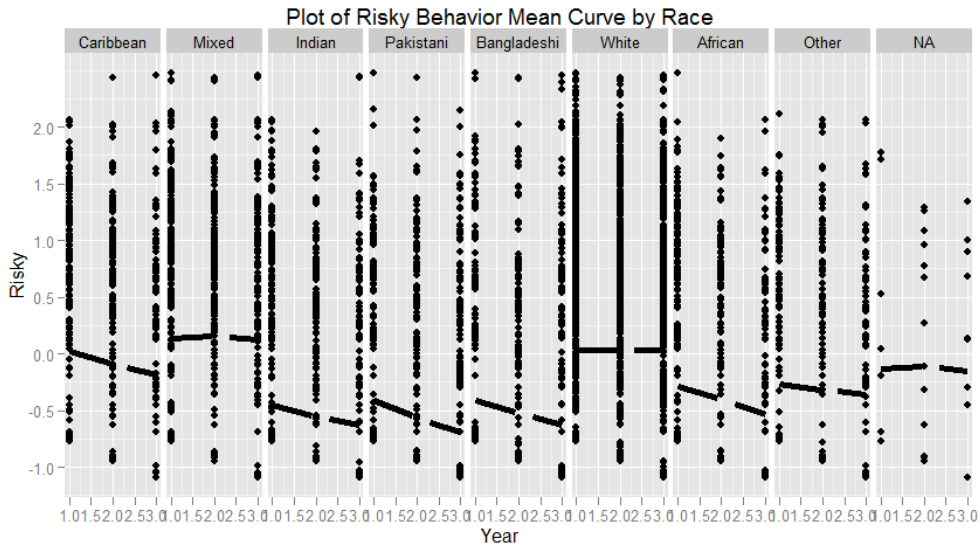


Figure 10. Young Person Risky Behavior over time by Race

Figure 11 is a plot of the logits of Parent Aspirations by Race over time. The reader should recall that parents were asked to indicate what they *wanted* their child to do after their child reached school leaving age. Parents' selected responses were collapsed into two categories, 0 = (Start an apprenticeship, Get a full time paying job, Something else) and 1 = (Continue in full time education, Start learning a trade/ Get a place on a training course). The plots suggest that there were mean differences in Parent Aspirations according to race, and there appears to be a general decrease in aspirations over time.

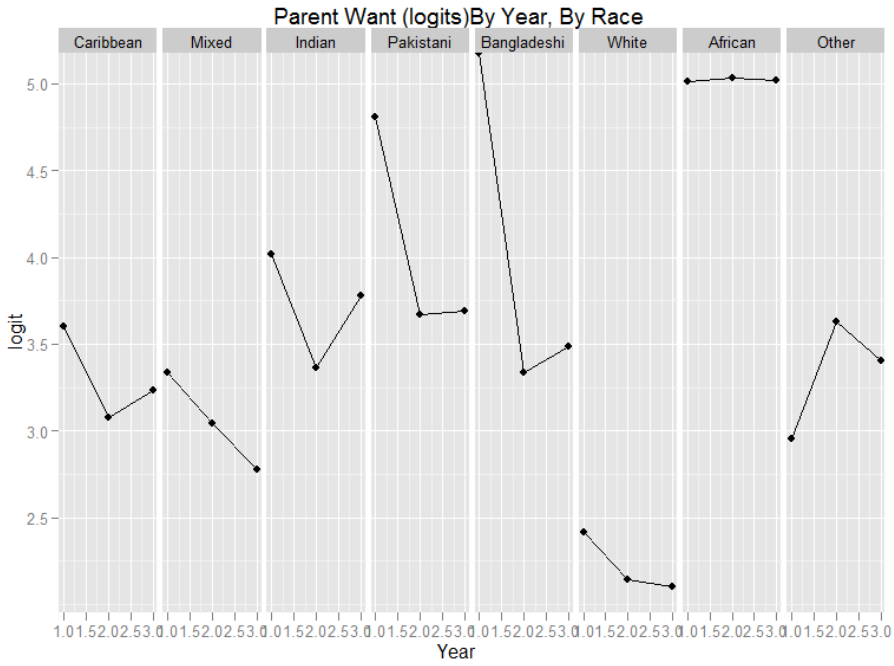


Figure 11. Parent Aspirations over Time by Race

Figure 12 is a plot of the logits of Parent Expectations by Race over Time. The reader should recall that parents were asked to indicate what they *expected* their child to do after their child reached school leaving age. Parents' selected responses were collapsed into two categories, 0 = (Start an apprenticeship, Get a full time paying job, Something else) and 1 = (Continue in full time education, Start learning a trade/ Get a place on a training course). The plots suggest that there were mean differences in Parent Aspirations according to race, though the White group is considerable lower on average as compared to other ethnic groups. Caribbean parent expectations appear to remain stable over time whereas Bangladeshi and Pakistani parent expectations appear to decrease over time. Finally, Mixed, Indian, African and Other appear to increase over time.

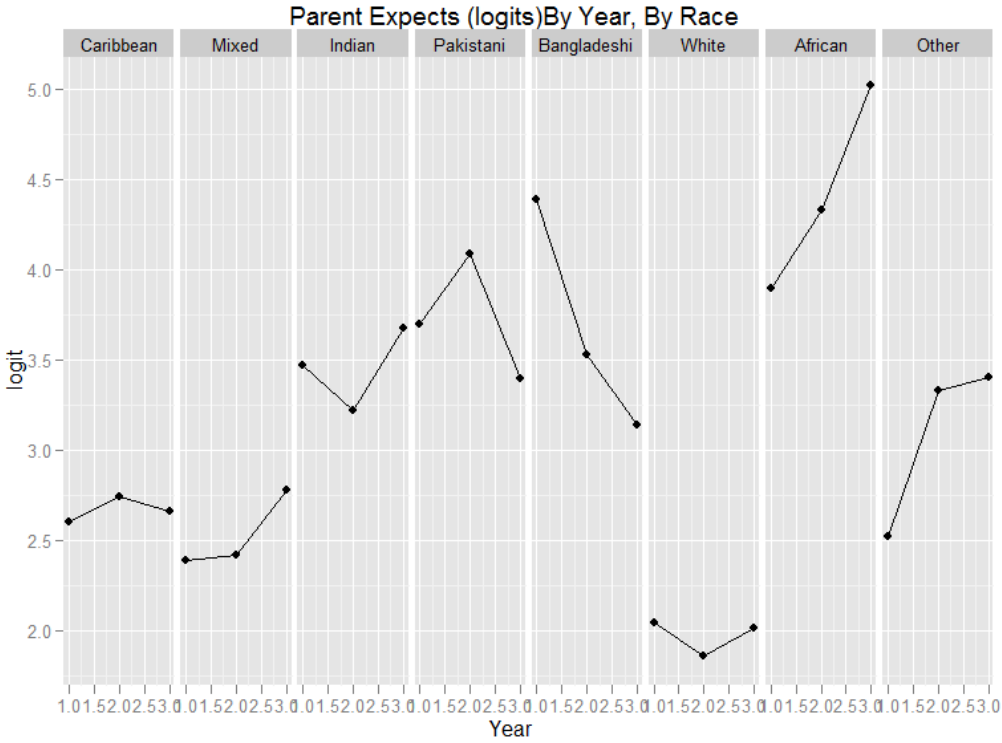


Figure 12. Parent Expectations over Time by Race

Figure 13 is a plot of the four point ordinal variable for Parent Perceived Involvement Recall that the variable "How involved do you Personally feel with your child's (young Person) school life?" was an ordinal variable ranging from 1 to 4 with, 1 = not involved at all, 2 = not very involved, 3 = fairly involved, and 4 = very involved. This was transformed into the probability metric for three splits over time. Reading from the top down, the lines can be interpreted as follows: - Split 1 (the probability of selecting a response higher than 1); Split 2 (the probability of selecting a 3 or a 4 versus a 1 or a 2); and Split 3, (the probability of selecting a 4).

The reader should note that the plot of the splits over time for an ordinal variable informs us as to whether the assumption of parallel lines for the slope is tenable. If the parallel lines assumption proved tenable, it would have been appropriate to model the growth curve using ordinal regression. Conversely, if the assumption appeared violated, then it would be more appropriate to model the growth curves using individual logistic

regressions for each split. This preliminary plot suggested that the assumption of parallel lines was tenable. To be more conclusive, this assumption was further tested by modeling individual logistic regressions on the splits and comparing these solutions to the ones provided by ordinal regression. The assumption of parallel lines was considered to be met because the solutions for the individual logistic regressions and the ordinal regression were similar in direction and magnitude. Therefore, growth curves for this outcome variable was modeled using ordinal regression. See Appendix II for the parallel lines assumption testing results.

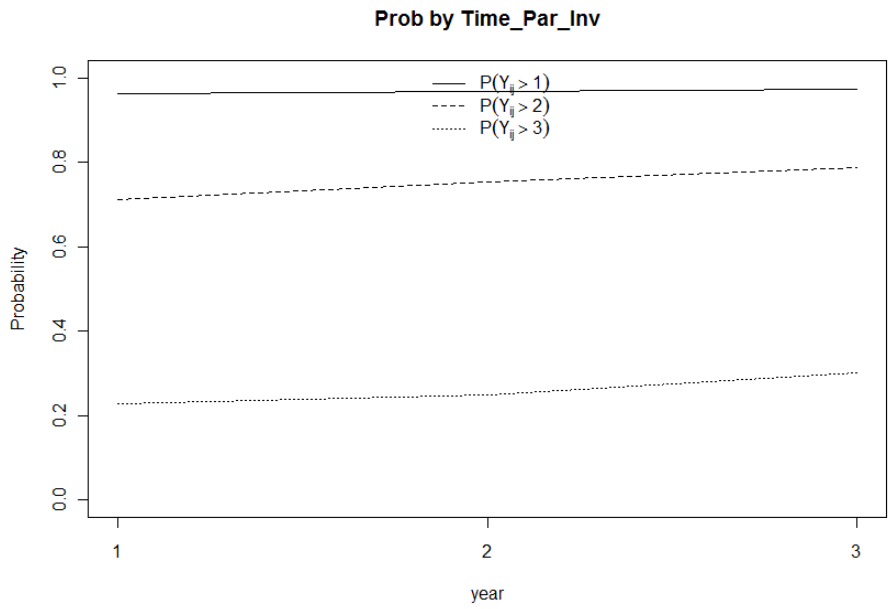


Figure 13. Parent Involvement over Time

Figure 14 is a plot of Parent Perceived Involvement over Time by Race for split 3. That is, this plot represents the probability of parents indicating that they are very involved with their child's school life. African parents appear to be the ones who were more likely to report being very involved with their child's life, and conversely, White parents appear to be the ones who were the least likely to report being very involved with their child's life. Caribbean, Mixed, Indian, Pakistani, Bangladeshi, and Other parents appeared to be similar in the probability of reporting being very involved with their

child's life. Aside from Bangladeshi, the growth curves for all other ethnic groups appeared to increase over time, suggesting that the likelihood of parents reporting that they were very involved increased over time.

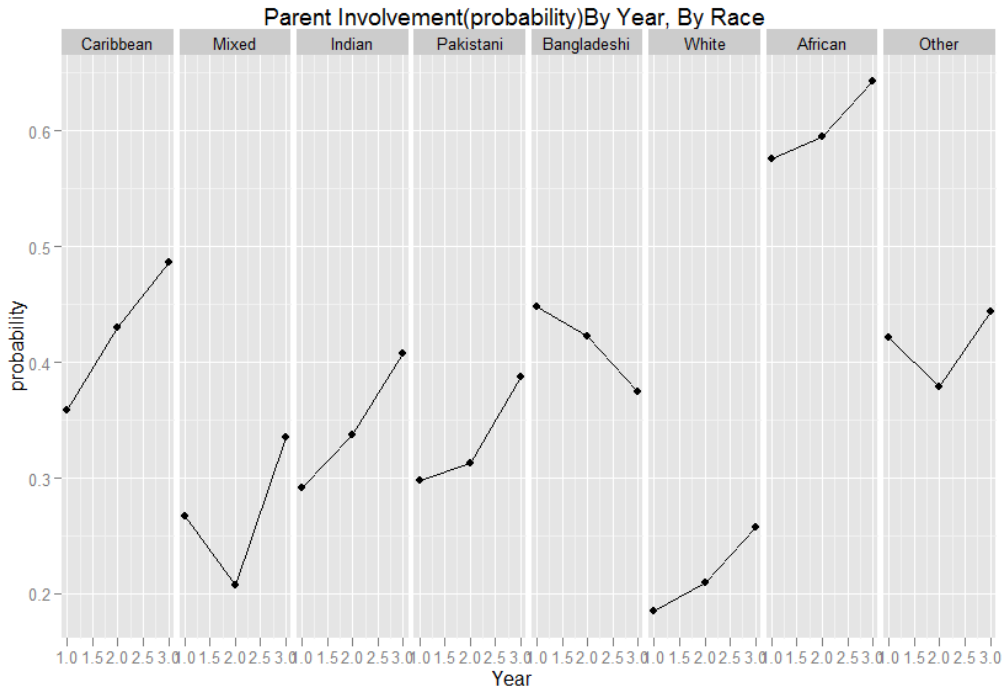


Figure 14. Parent Perceived Involvement over Time by Race: Probability of Parents indicating they were **very involved** with their child's school life.

Testing necessity of modeling school intercepts

To determine whether retaining random intercepts for school clusters were necessary in analyses, random intercept models for each outcome variable in this study were examined by fitting fully unconditional random intercepts models. School clusters were the highest level examined. The intra-class correlations for u_j were calculated and the results are found in Table 17. The results demonstrated that Risky Behavior was the only altitudinal/behavioral outcome variable that required modeling random intercepts for

school clusters. It is important to note that the intra-class correlation for Risky Behavior demonstrated only borderline importance.

Table 17

Intra-class correlations for fully unconditional models

	Individual Level Intercept Variance	School Level intercept Variance	Level 1 Residuals Variance	Intra-class Correlation	Decision
Attitude Towards School	0.4810	0.0344	0.3047	.04	Drop school clusters
Risky Behavior	0.3765	0.0344	0.2011	.06	Keep school clusters
Academic Self-Concept		0.0310	0.8074	.04	Drop school clusters
Perceived Discrimination		0.0083	0.6358	.01	Drop school clusters
State of Mental Health		0.0295	0.8383	.04	Drop school clusters
Parent Expectation*	21.141	$3.56\ e^{-05}$	NA	NA	Drop school clusters
Parent Aspiration*	16.776	$3.56\ e^{-21}$	NA	NA	Drop school clusters
Math Achievement KS3		17.101	47.738	.36	Keep school clusters
English Achievement KS3		11.416	27.834	.41	Keep school clusters
Science Achievement KS3		12.800	33.752	.38	Keep school clusters
HW		0.2056		NA	

Note. * level 3 random intercepts were dropped due to the size of their estimated variances rather the value of their intraclass correlations. Random intercepts for parent involvement could not be estimated because of a rank deficiency which resulted in models for this outcome variable being converted to marginal models.

Part II: Research Questions

Research Question 1

How do students of Caribbean descent compare to students of other ethnic groups on identified attitudinal and behavioral factors related to academic achievement?

Recall that the attitudes and behaviors examined in this study were: Young Person's Attitude Towards School, Young Person's Risky Behavior, Young Person's Academic Self Concept, Young Person's Perceived Discrimination, Young Person's State of Mental Health, Parent Expectation for their child continuing to tertiary education, Parent Desire/Aspiration for their child continuing to tertiary education, Parent Involvement with child's school life, and Help with Homework at Home. Five of these traits represented attitudes and behaviors measured over three time points (Waves 1,2 & 3) and the remaining traits represented attitudes and behaviors that were measured at only one time point (Wave 1 or Wave 2). For the longitudinal models, year was coded as a categorical variable of 1, 2, and 3.

Longitudinal

Question 1.1. What is the nature of the growth curves for each ethnic group for the following outcomes variables of interest:-

a. Young Person's Attitude Towards School (theta scores)
b. Young Person's Risky Behavior (theta scores)
c. Parental expectations (one dichotomized item)
d. Parental aspirations (one dichotomized item)
e. Parental Involvement with young Person's school progress (one ordinal item)

Models for Young Person Attitude Towards School:

Reduced Model

1. $\text{Attitude}_{ij} = (\gamma_{00} + b_{0i}) + \beta_1 \text{Year}_{ij} + (\beta_2 \text{Race}_{1i} \ \ldots \ \beta_8 \text{Race}_{7i}) + r_{ij}$

Full Model

2. $\text{Attitude}_{ij} = (\gamma_{00} + b_{0i}) + \beta_1 \text{Year}_{ij} + (\beta_2 \text{Race}_{1i} \ \ldots \ \beta_8 \text{Race}_{7i}) + (\beta_9 \text{Race}_{1i}\text{Year}_{ij} \ \ldots \ \beta_{15} \text{Race}_{7i}\text{Year}_{ij}) + r_{ij}$

i = individual

j = time

The results for the models predicting Young Person Attitude Towards School are in Table 18. These demonstrated that Race was a significant predictor of Young Person Attitude Towards School, however Year was not, nor was the interaction between Year * Race important. A model comparison was conducted on the Full Model versus the Reduced Model to arrive to the more parsimonious model. The results demonstrated that the Full model did not explain more than the Reduced model ($\chi^2 = 5.1244$, df 7, $p = .645$), therefore this study adopted the reduced model and reports that the Indian, Bangladeshi, Pakistani, African, and Other students display more positive attitudes towards school as compared to Caribbean students; whereas the Mixed group and the White group were not significantly different from the Caribbean students. Furthermore, the time effect was not significantly different from zero indicating that attitudes towards school were stable over time.

Table 18

Young Person Attitude Towards School regressed on Race and Time

	Attitude ~ Year + Race			Attitude ~ Year + Race + Year*Race		
Random Effects	Variance			Variance		
Individual intercepts (Level 2)	0.496			0.496		
Level 1 residuals	0.304			0.304		
Fixed Effects	Standardized	Std	*t* value	Standardized	Std	*t* value

	Coefficients	Error		Coefficients	Error	
(Intercept)	0.03	0.05	.674	0.07	0.08	0.89
Year	-0.0	0.00	-0.98	-0.02	0.03	-0.71
Mixed	-0.05	0.06	-1.88	-0.09	0.10	-0.93
Indian	0.41	0.06	7.18***	0.33	0.10	3.07**
Pakistani	0.37	0.06	6.30***	0.34	0.10	3.33***
Bangladeshi	0.32	0.07	4.89***	0.20	0.12	1.63
White	-0.03	0.05	-0.53	-0.06	0.08	-0.76
African	0.44	0.07	6.69***	0.43	0.11	4.01***
Other	0.25	0.07	3.68***	0.14	0.11	1.31
Year*Mixed				0.02	0.04	0.50
Year*Indian				0.04	0.04	1.07
Year*Pakistani				0.02	0.04	0.42
Year*Bangladeshi				0.06	0.05	1.21
Year*White				0.02	0.03	0.55
Year*African				0.00	0.04	0.10
Year*Other				0.06	0.04	1.37
Sample Size		11414			11414	
Deviance Statistic		73865			73860	
Df		11			18	
χ^2 *p*- value					.645	
Decision: Interaction term between Year and Race is not necessary in the model						

Note. * p <.05, ** p< .01, p <.001

Models for Young Person Risky Behavior:

Reduced Model

3. $Risky_{ijk} = (\gamma_{000} + \mu_{00k} + b_{0ik}) + \pi_1 Year_{ijk} + (\pi_2 Race_{1ik} \ \ldots \ \pi_8 Race_{7ik}) + r_{ijk}$

Full Model

4. $Risky_{ijk} = (\gamma_{000} + \mu_{00k} + b_{0ik}) + \pi_1 Year_{ijk} + (\pi_2 Race_{1ik} \ \ldots \ \pi_8 Race_{8ik}) + (\pi_9 Race_{1ik} Year_{ijk} \ldots \pi_{15} Race_{7ik} Year_{ijk}) + r_{ijk}$

i = individual

j = time

k = school

The results of Models 3 and 4 in Table 19 demonstrated that Race was a significant predictor of Young Person Risky Behavior, the main effect for Year was not, but the interaction between Year * Race was. A model comparison revealed that the Full

model was statistically significantly better at explaining variation compared to the Reduced model (χ^2 (7) = 155.75, p < .001), therefore this study adopted the full model. The main effects for Race in the interaction model (Model 4) demonstrated that Indian, Bangladeshi, and Pakistani students had less Risky Behavior as compared to Caribbean students; Mixed had more Risky Behavior compared to Caribbean students; and African, White and Other students were not significantly different from Caribbean students. However, the interaction between Year*Pakistani, Year*Bangladeshi, Year* African were significant and negative suggesting that the difference in Risky Behavior between Pakistani, Bangladeshi, and African students as compared to Caribbean students increased over time. In contrast, the interaction between Year *White was significantly positive indicating that at some time point, White students displayed more Risky Behavior as compared to Caribbean students. Figure 10 provides a visual representation of these Year*Ethnic group interactions.

Table 19

Young Person Risky Behavior regressed on Race and Time

Risky ~ Year + Race				Risky ~ Year + Race + Year*Race		
Random Effects			Variance		Variance	
Individual intercepts (Level 2)			0.361		.361	
School Clusters intercepts (Level 3)			0.0144		.014	
Level 1 residuals			0.200		.199	
Fixed Effects	Standardized Coefficients	Std Error	*t* value	Standardized Coefficients	Std Error	*t* value
(Intercept)	-0.15	0.04	-3.51***	-0.06	0.07	-0.91
Year	0.01	0.00	2.33**	-0.04	0.03	-1.35
Mixed	0.26	0.05	4.99***	0.18	0.08	2.24*
Indian	-0.40	0.05	-8.13***	-0.30	0.08	-3.66***
Pakistani	-0.43	0.05	-8.50***	-0.22	0.08	-2.69**
Bangladeshi	-0.39	0.06	-6.76***	-0.26	0.10	-2.58*
White	0.14	0.04	3.34***	0.03	0.07	0.43
African	-0.29	0.06	-5.09***	-0.08	0.09	-0.92
Other	-0.18	0.06	-3.04**	-0.15	0.09	-1.68
Year*Mixed				0.036	0.03	1.11
Year*Indian				-0.05	0.03	-1.58
Year*Pakistani				-0.10	0.03	-3.12**
Year*Bangladeshi				-0.06	0.04	-1.55
Year*White				0.06	0.03	2.09*
Year*African				-0.10	0.03	-2.96**

Year*Other		-0.01	0.03	-0.44
Sample Size	11413		11413	
Number of Clusters	656		656	
Deviance Statistic	60977		60821	
Df	12		19	
χ^2 *p*- value			< .001	
Decision: Interaction term between Year and Race is necessary in the model				

Note. * p <.05, ** p< .01, p <.001

Models for Parent Expectations and Parent Aspiration:

Reduced Model

5. $\text{Log}\left[\frac{P(Expec_{ij}=1|b_{01})}{1-P(Expec_{ij}=1|b_{01})}\right] = (\gamma_{00} + b_{0i}) + \beta_1 Year_{ij} + (\beta_{2i} Race_{1i} \ldots \beta_8 Race_{7i})$

Full Model

6. $\text{Log}\left[\frac{P(Expec_{ij}=1|b_{01})}{1-P(Expec_{ij}=1|b_{01})}\right] = (\gamma_{00} + b_{0i}) + \beta_1 Year_{ij} + (\beta_{2i} Race_{1i} \ldots \beta_8 Race_{7i}) + (\beta_9 Race_{1i} Year_{ij} \ldots \beta_{15} Race_{7i} Year_{ij})$

Reduced Model

7. $\text{Log}\left[\frac{P(Aspirations_{ij}=1|b_{01})}{1-P(Aspirations_{ij}=1|b_{01})}\right] = (\gamma_{00} + b_{0i}) + \beta_1 Year_{ij} + (\beta_{2i} Race_{1i} \ldots \beta_8 Race_{7i})$

Full Model

8. $\text{Log}\left[\frac{P(Aspirations_{ij}=1|b_{01})}{1-P(Aspirations_{ij}=1|b_{01})}\right] = (\gamma_{00} + b_{0i}) + \beta_1 Year_{ij} + (\beta_{2i} Race_{1i} \ldots \beta_8 Race_{7i}) + (\beta_9 Race_{1i} Year_{ij} \ldots \beta_{115} Race_{7i} Year_{ij})$

The results for Models 5 through 8 predicting Parent Expectations and Parent Aspirations are presented in Tables 20 and 21. Model comparisons of the full to the reduced models demonstrated that the interaction terms were not important to include in either model (Parent Expectations: ($\chi^2(7) = 2.81$, $p = .902$); Parent Aspirations ($\chi^2(7) = 2.12$, $p = .953$). Therefore, the reduced models were adopted. Race was not a significant predictors of Parent Expectations nor Parent Aspirations, though it should be noted that

the *p*-value for the African group was borderline ($p = .0576$). Further, Year was only important for predicting Parent Aspirations, with there being a statistically significant decrease over time ($p < .001$). The time effect for Parent Expectations approached significance ($p = .0722$).

Table 20

Parent Expectations regressed on Race and Time

	Parent_ Expectation ~ Year + Race			Parent_ Expectation ~ Year + Year * Race		
Random Effects		Variance			Variance	
Individual intercepts (Level 2)		9.56			11.12	
Fixed Effects	Standardized Coefficients	Std Error	*z* value	Standardized Coefficients	Std Error	*z* value
(Intercept)	4.81	0.44	10.86***	4.84	0.77	6.28***
Year	0.05	0.03	1.80	0.02	0.32	0.08
Mixed	-0.14	0.54	-0.27	-0.28	0.94	-0.29
Indian	0.95	0.66	1.44	0.82	1.19	0.07
Pakistani	0.97	0.67	1.44	1.44	1.30	1.12
Bangladeshi	0.89	0.92	0.97	1.98	2.50	0.79
White	-0.63	0.44	-1.43	-0.67	0.78	-0.87
African	1.66	0.87	1.90	1.36	1.56	0.88
Other	1.06	0.74	1.44	0.72	1.17	0.62
Year*Mixed				0.07	0.04	0.19
Year*Indian				0.07	0.51	0.15
Year*Pakistani				-0.22	0.54	-0.41
Year*Bangladeshi				-0.50	1.00	-0.50
Year*White				0.03	0.32	0.09
Year*African				0.16	0.67	0.24
Year*Other				0.19	0.46	0.41
Sample Size		11399			11399	
Deviance Statistic		25957			25954	
Df		10			17	
χ^2 *p*- value					.902	
Decision: Interaction term between Year and Race was not necessary to retain so it was dropped from the model.						

Note. *p <.05,** p < .01, ***p < .001

Table 21. *Parent Aspirations regressed on Race and Time*

	Parent_ Aspiration ~ Year + Race	Parent_ Aspiration ~ Year * Race

Random Effects		Variance			Variance	
Individual intercepts (Level 2)		16.358			16.441	
Fixed Effects	Standardized Coefficients	Std Error	*z* value	Standardized Coefficients	Std Error	*z* value
(Intercept)	7.00	0.77	9.21***	6.83	1.31	5.22***
Year	-0.28	0.03	-8.56***	-0.17	0.51	-0.34
Mixed	-0.34	0.90	-0.38	0.35	1.53	0.23
Indian	0.61	1.05	0.58	0.84	1.85	0.45
Pakistani	0.52	1.04	0.50	1.03	1.91	0.54
Bangladeshi	0.51	1.48	0.34	1.50	3.82	0.39
White	-1.04	0.77	-1.36	-0.85	1.32	-0.65
African	1.85	1.68	1.10	1.65	2.84	0.58
Other	0.71	1.17	0.61	0.19	1.77	0.11
				-0.33	0.58	-0.56
				-0.12	0.72	-0.17
				-0.25	0.74	-0.34
				-0.47	1.47	-0.32
				-0.10	0.51	-0.20
				0.10	1.11	0.09
				0.25	0.65	0.39
Sample Size		11413			11413	
Deviance		22420			22417	
Statistic						
Df		10			17	
χ^2 *p*- value					.953	
Decision: Interaction term between Year and Race was not necessary.						

Note. *p <.05,** p < .01, ***p < .001

Models for Parental Involvement with young Person's school progress:

Reduced Model

$$9a.\ \log\left[\frac{P(Invovlement_{ij}>c|b_{oi})}{1-P(Involvment_{ij}>c|b_{oi})}\right] = \alpha_c + \beta_1 Time_{ij} + \beta_2 Race_i \ldots \beta_8 Race_i + b_{oi}$$

Full Model

$$10a.\ \log\left[\frac{P(Invovlement_{ij}>c|b_{oi})}{1-P(Involvment_{ij}>c|b_{oi})}\right] = \alpha_c + \beta_1 Time_{ij} + \beta_2 Race_i \ldots \beta_8 Race_i +$$

$\beta_9 Time_{ij} * Race_i \ldots . \beta_{15} Time_{ij} * Race_i + b_{oi}$

α_c = the threshold cut pout

b_{oi} = individual random effect for the intercepts

Recall that it was intended to utilize random intercepts models to examine Parent Involvement, however the random effects ordinal regression models could not be estimated using the ordgee function in the geepack. The clmm function in the ordinal package was utilized however it did not provide estimates of the variance for individual intercepts. Therefore these models can be interpreted in light of their marginal counterparts as outlined below[5] .

Reduced Model

$$9b.\ \log\left[\frac{P(Invovlement_{ij}>c)}{1-P(Involvment_{ij}>c)}\right] = \alpha_c\ \beta_1 Time_{ij} + \ \beta_2 Race_i \ldots\ \beta_8 Race_i$$

Full Model

$$10b.\ \log\left[\frac{P(Invovlement_{ij}>c)}{1-P(Involvment_{ij}>c)}\right] = \alpha_c\ \beta_1 Time_{ij} + \ \beta_2 Race_i \ldots\ \beta_8 Race_i\ + \beta_9 Time_{ij} * Race_i \ldots \beta_{15} Time_{ij} * Race_i$$

The results of the marginal models 9b and 10b predicting Parent Involvement are found in Table 22. A model comparison revealed that the Reduced model was just as effective in explaining variation in Parent Involvement as compared to the Full model ($\chi^2(7) = 5.43$, $p = .607$), therefore the Reduced model was adopted. The results of the Reduced model showed that both Race and Time were significant predictors of Parent Involvement. On average, every ethnic group except for African parents reported significantly less involvement with their child's school life as compared to Caribbean parents. Conversely, African parents reported significantly more involvement than Caribbean parents. Furthermore, there was a general increase in Parents Perceived Involvement over the three years.

[5] The R packages designed to model random effects for ordinal data stated that only one grouping term could be modeled (R, package "ordinal" July 24, 2010), which was similar to the limitations of the lmer function in lme4. Models 9 and 10 were attempted, however R gave an error message stating that the data was rank deficient and that the clm might not have converged. Thus, the solutions provided were solutions to marginal models and not random intercepts models.

Table 22

Parent Involvement regressed on Race and Time

	Parent_ Involvement ~ Year + Race			Parent_ Involvement ~ Year + Race + Year*Race		
Random Effects	Variance			Variance		
Individual intercepts	Not provided			Not provided		
Threshold coefficients	Standardized Coefficients	Std Error	*z* value	Standardized Coefficients	Std Error	*z* value
1|2	-3.45	0.10	-35.5 ***	-3.56	0.24	-14.8***
2|3	-1.36	0.10	-14.4***	-1.50	0.24	-6.11***
3|4	0.75	0.09	7.97***	0.65	0.24	2.69**
Fixed Effects						
Year	0.16	0.01	13.5***	0.12	0.11	1.04
Mixed	-0.58	0.11	-5.36***	-0.88	0.29	-2.99**
Indian	-0.23	0.11	-2.02*	-0.58	0.30	-1.96*
Pakistani	-0.23	0.11	-1.98*	-0.46	0.30	-1.53
Bangladeshi	-0.07	0.14	-2.09*	-0.07	0.38	-.190
White	-0.79	0.09	-8.64***	-0.88	0.24	-3.67***
African	0.66	0.12	5.45***	0.61	0.34	1.92
Other	-0.23	0.12	-2.01*	-0.23	0.31	-.74
Year*Mixed				0.15	0.14	1.09
Year*Indian				0.18	0.14	1.29
Year*Pakistani				0.12	0.14	0.85
Year*Bangladeshi				0.00	0.17	0.00
Year*White				0.05	0.11	0.43
Year*African				0.02	0.15	0.16
Year*Other				-0.00	0.14	-0.01
Sample Size*	≈10294			≈10294		
Number of Clusters	NR			NR		
Log likelihood	-39506.40			-39503.68		
AIC	79034.80			79043.37		
Df	8			15		
No. of Hessian quads	4833.127			64259.16		
χ^2 *p*- value				.607		
Decision: Interaction term not needed in model						

Note. Exact sample size was not reported, only the number of observations deleted due to missingness (n = 13439 deleted). The number 13,439 was divided by 3 and subtracted from 15,770 to get the most conservative sample size for this model.

Longitudinal Models Summary

Overall, the results of the final models adopted demonstrated that when controlling for Race, there was no significant time effect for Attitude Towards School nor Parent Expectations; thus these attitudes and behaviors appeared stable over time. In contrast, Parents' Aspiration for their child to go onto higher education decreased over time, but their Involvement with their child's school life increased. Finally, Caribbean students displayed more Risky behavior compared to the majority of other races, and further, there was a significant interaction between time and Race for the model predicting Risky Behavior demonstrating that Risky Behavior was not stable within certain groups.

Compared to most other races, Caribbean students in general displayed less positive attitude towards school, more risky behavior, but had parents who display similar expectations and aspirations. Caribbean parents also tended to perceive themselves as more involved compared to parents from most other races.

Cross-sectional:

Question 1.2. How do the different ethnic groups compare on the factors outline below:-

a. Young Person's Academic Self Concept (theta scores)
b. Young Person's Perceived Discrimination (theta scores)
c. Young Person's State of Mental Health (theta scores)
d. Homework Help Young Person Receives at Home/Study Support (dichotomous variable)

Models 11 through 13 that addressed Question 1.2 were in the form:

11-13. $Y_i = \beta_0 + (\beta_1 Race_{1i} \ldots \beta_7 Race_{7i}) + r_i$

14. $\text{Log}\left[\frac{P(HWij=1)}{1-P(HWij=1)}\right] = \beta_0 + (\beta_1 Race_{1i} \ldots \beta_7 Race_{7i})$

The results of the cross sectional models are found in Tables 23 and 24 below. No model comparisons were necessary for the cross-sectional models because Race was the only predictor in the models. Recall that academic self concept was coded in a manner such that higher values indicated lower measures of this trait. The results for Model 11 indicated that students of Indian, Pakistani, African, and Other descent reported significantly higher academic self concept as compared to Caribbean students, whereas students of Mixed, Bangladeshi or White descent were similar to Caribbean students on this trait. For Perceived Discrimination, recall that higher scores represented students who responded that they were "treated the same as everyone" else or that they "did not break the school rules"; whereas lower scores represented those who responded "more so than others" or "less so than others". The results from Model 12 indicated that White (*p* =.001) held significantly lower perceptions of discrimination as compared to Caribbean students. Mixed, Pakistani, Indian and Bangladeshi were similar to Caribbean students whereas Africans perceived more discrimination compared to Caribbean students. The results for Model 13 indicated that only Mixed and Other students reported significantly higher mental health issues as compared to Caribbean students. All other ethnic groups were not different in mental health from Caribbean students. Finally, recall that Help with Homework at home was coded 1 for "yes", and 2 for "no". Bangladeshi and Other reported more help with homework at home and White reported less help with homework at home compared to Caribbean students. All other ethnic groups were not significantly different from Caribbean students in receiving homework help at home.

Table 23

Young Person Academic Self Concept and Young Person Perceived Discrimination by Race

	Academic Self Concept ~ Race			Discrimination ~ Race		
	Estimate	Std Error	*t* value	Estimate	Std Error	t value
(Intercept)	-0.05	0.01	-5.42***	-0.05	0.06	-5.34 ***
Mixed	0.04	0.08	0.512	0.15	0.08	1.95
Indian	-0.26	0.08	-3.12**	-0.14	0.08	-1.78
Pakistani	-0.21	0.09	-2.44*	-0.03	0.08	-0.35
Bangladeshi	-0.14	0.11	-1.35	-0.02	0.10	-0.20
White	0.081	0.07	1.16	0.20	0.06	3.23 **

African	-0.28	0.10	-2.82**	-0.17	0.08	-2.07*
Other	-0.23	0.09	-2.61**	-0.02	0.08	-0.26
Sample Size		15408			13116	
Adjusted R-squared		.009			.009	
p-value		< .001			< .001	

Note. * $p < .05$, ** $p < .01$, ***, $p < .001$

Table 24

Young Person Mental Health and Help with Homework by Race

	Mental Health ~ Race			HW ~ Race		
Fixed Effects	Standardized Coefficients	Std Error	*t* value	Standardized Coefficients	Std Error	*t* value
(Intercept)	-0.03	0.07	-2.57*	-0.00	0.00	-0.02
Mixed	0.21	0.08	2.48 *	0.16	0.04	0.85
Indian	-0.12	0.09	-1.34	0.11	0.04	0.62
Pakistani	-0.15	0.09	-1.74	-0.23	0.04	-1.12
Bangladeshi	-0.04	0.11	-0.37	-0.53	0.05	-2.32 *
White	0.09	0.07	1.24	0.34	0.03	2.04*
African	-0.13	0.09	-1.36	0.08	0.04	0.33
Other	0.26	0.09	3.02**	-0.50	0.04	-2.83* *
Sample Size		13108			13061	
Adjusted R-squared		.004		.	.007	
p-value		<.001		<.001		

Note. *p <.05,** $p < .01$, ***$p < .001$

Summary for Cross-sectional Models

The cross-sectional models' results demonstrated that the attitude in which students of different ethnic groups differed the most from Caribbean students was Young Person Academic Self Concept. Compared to the majority of the other races, Caribbean students had lower Academic Self Concept. Otherwise, Caribbean students were more similar than different to at least half of the other ethnic groups in their perceptions of discrimination, their state of mental health, and the amount of help with homework at home.

Research Question 2

Q.2.1. Is there an achievement gap between girls and boys of Caribbean descent? If so, when does the gap appear? How does this gap compare when looking at the general population and also at the different ethnic groups?

Independent sample t tests comparing girls to boys were run on Math, English, and Science achievement scores at KS2 and KS3 time points. These t tests were run on each ethnic group and the LSYPE sample as a whole to determine whether the achievement patterns observed in the population were mirrored within each ethnic group as well. The results of these t tests are found in Tables 25 through 32. They demonstrate that at Key Stage 2 (6^{th} grade) Caribbean girls outperform Caribbean boys in English, and Science but performing similarly in Math. This trend continues in favor of Caribbean girls at Key Stage 3 (9th grade) with girls outperforming boys in each of the content areas. When examining the entire LSYPE sample at Key Stage 2 the picture is slightly different. Boys outperform girls in math, girls outperform boys in English, and boys and girls perform similarly in science. By Key Stage 3, girls and boys perform similarly in math and science, but girls still have an advantage in English.

When examining the difference between girls and boys within their ethnic groups, five out of the seven groups have very similar performance patterns. These patterns bear semblance to what is displayed when looking at the students as a whole group. That is, for Mixed, Indian, Pakistani, and Bangladeshi students, girls only outperform boys in English at both time points; otherwise both girls and boys perform similarly in the other content areas. Similarly, White girls outperform their male counterparts in English at both KS2 and KS3, however White boys outperform their girls in Math at KS2. Further, the *p*-value in favor of boys at KS2 in Science was borderline significant ($p = .055$). By KS3 however, there is no difference between White girls and boys in Math and Science, though again the *p*-values for Math at KS3 in favor of boys was borderline significant ($p = .057$).

The performance pattern for the final ethnic group, African, was the most similar to Caribbean students. That is, African girls outperformed their boys in English at the KS2, but performed similarly to them in Math and Science. In contrast, by KS3, African girls outperformed African boys in each content area.

Table 25

Mean, Standard Error, and Effect size (Cohen's d) of English, Math, and Science scores at KS2 and KS3 of all students in LSYPE database

Content Area	Grade Level		N	Mean	SE	*t*- value	Effect size	df	*p*-value	Who does better?
English	KS2	M	7138	25.7	.054	-19.3	.32	14059.708	.000	Girls
		F	6981	27.1	.050					
	KS3	M	7105	31.9	.074	-21.6	.38	14050.401	.000	Girls
		F	6973	34.2	.070					
Math	KS2	M	7141	26.6	.059	5.36	.10	14111.118	.000	Boys
		F	6987	26.2	.057					
	KS3	M	7226	35.4	.097	1.30	.025	14292.356	.192	Same
		F	7081	35.2	.093					
Science	KS2	M	7133	28.1	.046	0.58	.010	14093.456	.561	Same
		F	6967	28.1	.045					
	KS3	M	7153	32.7	.083	-1.44	.015	14160.015	.150	Same
		F	7021	32.8	.080					

Note. M = Male, F = Female

Table 26

Mean, Standard Error, and Effect size (Cohen's d) of English, Math, and Science scores at KS2 and KS3 of Caribbean students in LSYPE database

Content Area	Grade Level		N	Mean	SE	*t*- value	Effect size	Df	*p*-value	Who does better?
English	KS2	Male	253	24.4	.292	-5.618	.50	498.3	.000	Girls
		Female	256	26.6	.257					
	KS3	Male	263	30.1	.345	-6.719	.58	536	.000	Girls
		Female	275	33.4	.339					
Math	KS2	Male	251	24.7	.303	-.939	.085	507	.348	Same
		Female	258	25.1	.288					

	KS3	Male	269	31.2	.472	-2.342	.19	546	.020	Girls
		Female	279	32.7	.459					
Science	KS2	Male	252	26.8	.251	-2.448	.22	506	.015	Girls
		Female	256	27.6	.220					
	KS3	Male	266	29.2	.398	-3.278	.28	543	.001	Girls
		Female	279	31.1	.402					

Table 27

Mean, Standard Error, and Effect size (Cohen's d) of English, Math, and Science scores at KS2 and KS3 of Mixed students in LSYPE database

Content Area	Grade Level		N	Mean	SE	*t*- value	Effect size	df	*p*- value	Who does better?
English	KS2	Male	342	25.9	0.239	-5.11	.38	718	.000	Girls
		Female	378	27.5	0.222					
	KS3	Male	345	32.5	0.317	-4.21	.31	725	.000	Girls
		Female	382	34.4	0.296					
Math	KS2	Male	346	26.5	0.260	.417	.021	724	.677	Same
		Female	380	26.4	0.244					
	KS3	Male	346	35.6	0.429	.487	.039	733	.627	Same
		Female	389	35.3	0.384					
Science	KS2	Male	340	28.2	0.198	-.786	.054	716	.432	Same
		Female	378	28.4	0.193					
	KS3	Male	346	32.9	0.363	-.335	.015	725	.737	Same
		Female	381	33.0	0.334					

Table 28

Mean, Standard Error, and Effect size (Cohen's d) of English, Math, and Science scores at KS2 and KS3 of Indian students in LSYPE database

Content Area	Grade Level		N	Mean	SE	*t*- value	Effect Size	df	*p*- value	Who does better?
English	KS2	Male	505	25.7	0.184	-5.191	.33	957	.000	Girls
		Female	454	27.1	0.186					
	KS3	Male	506	32.7	0.260	-5.140	.33	964	.000	Girls
		Female	460	34.6	0.257					
Math	KS2	Male	505	27.0	0.216	1.235	.079	956	.217	Same
		Female	453	26.6	0.222					
	KS3	Male	517	37.0	0.349	0.644	.038	983	.520	Same

		Female	468	36.7	0.368					
Science	KS2	Male	506	27.4	0.173	-1.423	.09	957	.155	Same
		Female	453	27.8	0.175					
	KS3	Male	514	33.1	0.295	-0.725	.04	976	.469	Same
		Female	464	33.4	0.307					

Table 29

Mean, Standard Error, and Effect size (Cohen's d) of English, Math, and Science scores at KS2 and KS3 of Pakistani students in LSYPE database

Content Area	Grade Level		N	Mean	SE	*t*- value	Effect Size	df	*p*- value	Who does better?
English	KS2	Male	426	24.0	.221	-4.033	.28	859	.000	Girls
		Female	435	25.3	.219					
	KS3	Male	439	29.8	.274	-5.352	.36	889	.000	Girls
		Female	452	31.9	.283					
Math	KS2	Male	431	24.5	.241	.803	.05	863	.422	Same
		Female	434	24.2	.236					
	KS3	Male	446	32.5	.382	.998	.07	897	.318	Same
		Female	453	31.9	.387					
Science	KS2	Male	430	25.8	.211	-.611	.04	862	.541	Same
		Female	434	25.9	.211					
	KS3	Male	441	29.5	.316	-.232	.01	896	.817	Same
		Female	457	29.6	.331					

Table 30

Mean, Standard Error, and Effect size (Cohen's d) of English, Math, and Science scores at KS2 and KS3 of Bangladeshi students in LSYPE database

Content Area	Grade Level		N	Mean	SE	*t*- value	Effect size	df	*p*- value	Who does better?
English	KS2	Male	426	24.0	.221	-4.033	.30	859	.000	Girls
		Female	435	25.3	.219					
	KS3	Male	439	29.8	.274	-5.352	.48	889	.000	Girls
		Female	452	31.9	.283					
Math	KS2	Male	431	24.5	.241	.803	.04	863	.422	Same
		Female	434	24.2	.236					
	KS3	Male	446	32.5	.382	.998	.01	897	.318	Same
		Female	453	31.9	.387					

Science	KS2	Male	430	25.8	.211	-.611	.01	862	.541	Same
		Female	434	25.9	.211					
	KS3	Male	441	29.5	.316	-.232	.13	896	.817	Same
		Female	457	29.6	.331					

Table 31

Mean, Standard Error, and Effect size (Cohen's d) of English, Math, and Science scores at KS2 and KS3 of White students in LSYPE database

Content Area	Grade Level		N	Mean	SE	*t*- value	Effect size	df	*p*-value	Who does better?
English	KS2	Male	4963	26.0	.064	-16.2	.33	9618.3	.000	Girls
		Female	4681	27.4	.059					
	KS3	Male	4784	32.4	.091	-17.0	.35	9309.7	.000	Girls
		Female	4530	34.5	.087					
Math	KS2	Male	4957	27.0	.070	5.29	.10	9639.7	.000	Boys
		Female	4685	26.5	.068					
	KS3	Male	4868	36.1	.116	1.90	.04	9478.0	.057	Same
		Female	4612	35.8	.113					
Science	KS2	Male	4955	28.6	.052	1.92	.06	9619.0	.055	Same
		Female	4668	28.4	.051					
	KS3	Male	4813	33.5	.098	.125	.00	9373.9	.901	Same
		Female	4563	33.5	.095					

Table 32

Mean, Standard Error, and Effect size (Cohen's d) of English, Math, and Science scores at KS2 and KS3 of African students in LSYPE database

Content Area	Grade Level		N	Mean	SE	*t*- value	Effect Size	df	*p*-value	Who does better?
English	KS2	Male	196	24.8	0.347	-3.31	.32	422	.001	Girls
		Female	228	26.3	0.289					
	KS3	Male	273	30.3	0.365	-5.69	.49	561	.000	Girls
		Female	290	33.1	0.344					
Math	KS2	Male	196	25.2	0.358	-.170	.02	422	.865	Same
		Female	228	25.3	0.334					
	KS3	Male	275	31.7	0.509	-2.01	.17	567	.045	Girls
		Female	294	33.1	0.477					
Science	KS2	Male	195	26.7	0.311	-1.13	.09	423	.259	Same

	Female	230	27.1	0.274					
KS3	Male	275	29.1	0.457	-2.41	.20	567	.016	Girls
	Female	4563	33.5	0.095					

Question 2.2. Are the achievement gains between Caribbean boys and girls similar between Key Stage 2 and Key Stage 3? If so, how do these gains compare to the gains amongst girls and boys from other ethnic groups?

To address this question, parallel regressions for each ethnic group were carried out in the form of models 15-38 as indicated below.

Models 15-38

$KS3_i = \beta_0 + \beta_1 KS2_i + \beta_2 Sex_i + r_i$ (Ethnic minority groups)

$KS3_{ij} = \gamma_{00} + \mu_{0j} + \beta_{1j} KS2_{ij} + \beta_{2j} Sex_{ij} + r_{ij}$ (White group & Other group)

μ_{0j} = random effect for the intercept

The results of the parallel regressions are found in Tables 33 through 48. The results demonstrated that after controlling for prior achievement, Caribbean and White girls made more progress in all three content areas compared to their male counterparts. African girls made more progress than boys in Math and English but not Science. Mixed girls were not different from Mixed boys in any content area. Pakistani, Bangladeshi, and Indian girls made more progress than their male counterparts in English, but made similar progress in Math and Science.

Table 33

Math and English Regression Results for Caribbean Students

Caribbean Math			Caribbean English		
	Estimate (Std Error)	*t* value		Estímate (Std Error)	*t* value
Intercept	34.4 (0.19)	185.7***	Intercept	32.8 (0.16)	201.4***
Math_1	1.37	36.4***	Eng_1	0.97	26.5***

	(0.04)			(0.04)	
Sex	0.84	2.37*	Sex	1.17	3.56***
	(0.35)			(0.34)	
Df	502		Df	492	
Adj. R^2	.726		Adj. R^2	.619	
$F_{2,503)}$	670.1		$F_{(2, 492)}$	403.9	
p-value	<.001		*p*-value	<.001	

Note. * $p < .05$, ** $p<.01$, *** $p <.001$

Table 34

Science Regression Results for Caribbean Students

Caribbean Science		
	Estimate (Std Error)	*t* value
Intercept	31.5	154.0 ***
	(0.16)	
Science_1	1.23	23.0 ****
	(0.05)	
Sex	0.801	2.00*
	(0.42)	
Df	498	
Adj. R^2	.521	
$F_{(2,503)}$	273.1	
p-value	2.2e-16	

Note. * $p < .05$, ** $p<.01$, *** $p <.001$.

Table 35

Math and English Regression Results for Mixed Students

Mixed Math			Mixed English		
	Estimate (Std Error)	*t* value		Estimate (Std Error)	*t* value
Intercept	35.4	250.2***	Intercept	33.2	251.5**
	(0.14)			(0.13)	
Math_1	1.39	46.2***	Eng_1	1.06	34.6**
	(0.03)			(0.03)	
Sex	.223	0.788	Sex	0.282	1.06
	(0.28)			(0.27)	
Df	696		Df	684	
Adj. R^2	.753		Adj. R^2	.643	
$F_{(2,696)}$	1067		$F_{(2,684)}$	618.8	
p-value	<.001		*p*-value	<.001	

Note. * $p < .05$, ** $p<.01$, *** $p <.001$

Table 36

Science Regression Results for Mixed Students

	Mixed Science	
	Estimate (Std Error)	*t* value
Intercept	32.8 (0.16)	202.1**
Science_1	1.33 (0.05)	29.7***
Sex	-0.217 (0.32)	-0.671
Df	682	
Adj. R^2	.564	
$F_{(2,682)}$	442.9	
p-value	<.001	

Note. * $p < .05$, ** $p<.01$, *** $p <.001$

Table 37

Math and English Regression Results for Indian Students

Indian Math			Indian English		
	Estimate (Std Error)	*t* value		Estimate (Std Error)	*t* value
Intercept	36.3 (0.12)	305.0	Intercept	33.7 (0.11)	299.1***
Math_1	1.44 (0.03)	57.8***	Eng_1	1.08 (0.03)	38.8***
Sex	.244 (0.24)	1.03	Sex	0.574 (0.23)	2.51**
Df	943		Df	927	
Adj. R^2	.779		Adj. R^2	.630	
$F_{(2,943)}$	1669		$F_{(2,927)}$	790.6	
p-value	<.001		*p*-value	<.001	

Note. * $p < .05$, ** $p<.01$, *** $p <.001$

Table 38

Science Regression Results for Indian Students

	Indian Science	
	Estimate (Std Error)	*t* value
Intercept	33.9 (0.13)	261.3***
Science_1	1.35	39.8***

	(0.03)	
Sex	-0.049	-0.189
	(0.26)	
Df	940	
Adj. R^2	.627	
$F_{(2,940)}$	793.8	
p-value	<.001	

Note. * $p < .05$, ** $p<.01$, *** $p <.001$

Table 39

Math and English Achievement Results for Pakistani Students

Pakistani Math			Pakistani English		
	Estimate (Std Error)	*t* value		Estimate (Std Error)	*t* value
Intercept	35.2	233.7	Intercept	32.8	257.9***
	(0.15)			(0.13)	
Math_1	1.40	49.6	Eng_1	1.03	39.0***
	(0.03)			(0.03)	
Sex	0.199	0.711	Sex	1.047	4.35***
	(0.29)			(0.24)	
Df	844		Df	833	
Adj. R^2	.744		Adj. R^2	.659	
$F_{(2,844)}$	1228		$F_{(2,833)}$	807	
p-value	<.001		*p*-value	<.001	

Note. * $p < .05$, ** $p<.01$, *** $p <.001$

Table 40

Science Achievement Regression Results for Pakistani Students

Pakistani Science		
	Estimate (Std Error)	*t* value
Intercept	32.4	194.5***
	(0.30)	
Science_1	1.17	34.2***
	(0.03)	
Sex	0.350	1.17
	(0.30)	
Df	841	
Adj. R^2	.582	
$F_{(2,841)}$	586.9	
p-value	<.001	

Note. * $p < .05$, ** $p<.01$, *** $p <.001$

Table 41

Math and English Regression Results for Bangladeshi Students

Bangladeshi Math			Bangladeshi English		
	Estimate (Std Error)	*t* value		Estimate (Std Error)	*t* value
Intercept	35.0 (0.17)	200.5	Intercept	32.6 (0.14)	241.2***
Math_1	1.32 (0.03)	39.5***	Eng_1	0.952 (0.03)	33.4***
Sex	0.248 (0.34)	.726	Sex	1.28 (0.27)	4.80***
Df	639		Df	627	
Adj. R^2	.709		Adj. R^2	.657	
$F_{(2,639)}$	779.2		$F_{(2,627)}$	602.8	
p-value	<.001		*p*-value	<.001	

Note. * $p < .05$, ** $p<.01$, *** $p <.001$

Table 42

Science Regression Results for Bangladeshi Students

Bangladeshi Science		
Fixed Effects	Estimate (Std Error)	*t* value
Intercept	32.1 (0.20)	158.7***
Science_1	1.14 (0.05)	25.2***
Sex	.591 (0.41)	1.80
Df	632	
Adj. R^2	.502	
$F_{(2,639)}$	319.9	
p-value	<.001	

Note. * $p < .05$, ** $p<.01$, *** $p <.001$

Table 43

Math and English Regression Results for White Students

White Math			White English		
Random Effects	Variance		Random Effects		
Cluster Intercepts	1.9910		Cluster Intercepts	2.8227	
Residuals (Lvl 1)	11.0339		Residuals (Lvl 1)	9.8876	
Fixed Effects	Estimate	*t* value	Fixed Effects	Estimate	*t* value

	(Std Error)			(Std Error)	
Intercept	35.5	506.8***	Intercept	33.1	417.6***
	(0.07)			(0.08)	
Math_1	1.40	176.2***	Eng_1	1.09	126.1***
	(0.01)			(0.01)	
Sex	0.433	6.00***	Sex	0.643	9.12***
	(0.07)			(0.07)	
Sample Size	9180		Sample Size	9037	
No. of Clusters	609		No. of Clusters	605	
AIC	48845		AIC	47289	
BIC	48880		BIC	47325	
Deviance	48835		Deviance	47279	

Note. * $p < .05$, ** $p<.01$, *** $p <.001$

Table 44

Science Regression Results for White Students

White Science		
Random Effects	Variance	
Cluster Intercepts	3.0484	
Residuals (Lvl 1)	14.2395	
Fixed Effects	Estimate (Std Error)	*t* value
Intercept	32.9	386.6***
	(0.09)	
Science_1	1.37	111.7 ***
	(0.01)	
Sex	0.245	2.96**
	(0.08)	
Sample Size	9083	
No. of Clusters	607	
AIC	50716	
BIC	50752	
Deviance	50706	

Note. * $p < .05$, ** $p<.01$, *** $p <.001$

Table 45

Math and English Regression Results for African Students

African Math			African English		
	Estimate (Std Error)	*t* value		Estimate (Std Error)	*t* value
Intercept	35.3	167.4***	Intercept	5.88	5.55***
	(0.21)			(1.06)	
Math_1	1.34	32.70***	Eng_1	0.969	25.56***

	(0.04)			(0.04)	
Sex	0.90	2.19*	Sex	1.34	3.81***
	(0.41)			(0.35)	
Df	417		Df	413	
Adj. R^2	.718		Adj. R^2	.636	
$F_{(2,417)}$	534.6		$F_{(2,413)}$	364.3	
p-value	<.001		*p*-value	<.001	

Note. * $p < .05$, ** $p<.01$, *** $p <.001$

Table 46

Science Achievement Results for African Students

African Science		
Fixed Effects	Estimate (Std Error)	*t* value
Intercept	32.7 (0.24)	137.8***
Science_1	1.20 (0.05)	22.06***
Sex	0.38 (0.46)	0.84
Df	417	
Adj. R^2	.537	
$F_{(2,417)}$	244.1	
p-value	<.001	

Note. * $p < .05$, ** $p<.01$, *** $p <.001$

Table 47

Math and English Regression Achievement LSYPE overall

Overall Math			Overall English		
Random Effects	Variance		Random Effects	Variance	
Cluster intercepts	2.08		Cluster Intercepts	2.77	
Residuals (Lvl 1)	11.2		Residuals (Lvl 1)	9.8	
Fixed Effects	Estimate (Std Error)	*t* value	Fixed Effects	Estimate (Std Error)	*t* value
Intercept	35.5 (0.07)	540.3	Intercept	33.1 (0.07)	452.5
Math_1	1.39 (0.01)	211.9	Eng_1	1.07 (0.01)	151.9
Sex	0.42 (0.06)	6.9	Sex	.680 (0.06)	11.7
Sample Size	13574		Sample Size	13369	
No. of Clusters	639		No. of Clusters	632	
AIC	72338		AIC	69708	

BIC	72375	BIC	69745
Deviance	72328	Deviance	69698

Table 48

Science Regression Achievement overall

Overall Science		
Random Effects	Variance	
Cluster Intercepts (Level 2)	3.20	
Residuals (Level 1)	14.4	
Fixed Effects	Estimate (Std Error)	t value
Intercept	32.9 (0.08)	410.1
Science_1	1.34 (0.01)	134.0
Sex	0.22 (0.07)	3.1
Sample Size	13449	
No. of Clusters	634	
AIC	75140	
BIC	75178	
Deviance	75130	

Summary for Research Question 2

Taken together, the results of Research Question 2.1 demonstrated that Caribbean girls outperformed Caribbean boys in English and Math at KS2, and in all three content areas by KS3.

When looking at the LSYPE database as a whole, achievement trends paint a different picture (Table 49). That is, at Key Stage 2, in general boys outperformed girls in math, and girls outperformed boys in English, but both sexes performed similarly in Science. In contrast, by Key Stage 3, both boys and girls performed similarly in math and science, however girls again outperform boys in English. Mean differences at Key Stages 2 and 3 suggest that the girls caught the boys up in math, but the gap in favor of girls for English remained. Most of these patterns are mirrored within the majority of the ethnic

groups, with the exception of African. Therefore, the African and Caribbean groups appear most similar in terms of the girl advantage, especially at Key Stage 3.

Parallel regressions compared boys and girls from each ethnic group on the progress they made between Key Stage 2 and Key Stage 3 in the three content areas. The results of these analyses highlighting the sex effect are summarized in Table 50 below. Interestingly, Whites and Caribbean were the only ethnic groups where girls consistently made more progress than boys in each of the content areas. It is important to note though in terms of statistical significance that the Caribbean girls' advantage in Science progress was only borderline significant ($t_{498} = 2.00$, $p = .047$). This was followed by the African group where girls made more progress than boys in Math and English, but not Science. Amongst the Indian, Pakistani and Bangladeshi students, girls only made more progress than boys in English . For the Mixed group, boys and girls performed similarly in every content area. The group, Other, was not modeled for these analyses because they represented a conglomerate of other minority groups of small percentages in England, and were not a group of interest for parallel regressions.

Overall, these results demonstrate that girls' performance relative to boys was moderated by ethnic group, and although girls made more progress than boys between Key Stage 2 to Key Stage 3, the size and significance of their progress was not always important when examining the groups in isolation.

Table 49

Comparative summary of girls and boys performance in English, Math, and Science at KS2 and KS3 time points

	Who did Better?					
	Key Stage 2			Key Stage 3		
	English	Math	Science	English	Math	Science
Caribbean	Girls	Same	Girls	Girls	Girls	Girls
African	Girls	Same	Same	Girls	Girls	Girls
Mixed	Girls	Same	Same	Girls	Same	Same
Indian	Girls	Same	Same	Girls	Same	Same

Pakistani	Girls	Same	Same	Girls	Same	Same
Bangladeshi	Girls	Same	Same	Girls	Same	Same
White	Girls	Boys	Same (#)	Girls	Same (#)	Same
Overall	Girls	Boys	Same	Girls	Same	Same

Note. # indicates borderline *p*-value (≈.055) in favor of boys

Table 50

Comparative Summary of the Sex effect in favor of females' progress in Math, English and Science between KS2 and KS3

	Significance of Sex Effect in favor of girls (*t*-value)		
	Math	English	Science
Caribbean	Significant (2.17)*	Significant (3.92)***	Significant (2.00*)
Mixed	Non-significant (0.53)	Non-significant (0.95)	Non-significant (-0.681)
Indian	Non-significant (1.62)	Significant (2.79)**	Non-significant (0.27)
Pakistani	Non-significant (0.84)	(Significant) (4.15)***	Non-significant (0.72)
Bangladeshi	Non-significant (1.13)	(Significant) (4.74)***	Non-significant (1.44)
White	Significant (5.97)***	Significant (9.12)***	Significant (2.96)**
African	Significant (2.20)*	Significant (3.81)***	Non-significant (.836)
Overall	Significant (6.90)***	Significant (11.70) ***	Significant (3.10)**

Note. * $p < .05$, ** $p<.01$, *** $p <.001$

Research Question 3

Q.3. What types of schools, if any, may ameliorate the achievement gap between boys and girls of Caribbean descent?

It was of interest to determine whether there were schools that were not only more equitable in their gender-achievement relationship but of which boys attending these schools generally performed at least one standard deviation above the boy average as well. In addition, the presence of a contextual effect for gender as well as a significant cross level interaction between the School Rank and gender were also explored. The model below addressed these questions.

Models 39-41

3a.i) Random coefficient models for English, math, and science.

Level-1 Model

$$KS3_{ij} = \beta_{0j} + \beta_{1j}KS2_{ij} + \beta_{2j}SEX_{ij} + r_{ij}$$

Level-2 Model

$$\beta_{0j} = \gamma_{00} + \gamma_{01}(\text{Sex\_Mean})_j + \gamma_{02}(\text{KS2\_Mean})_j + u_{0j}$$

$$\beta_{1j} = \gamma_{10}$$

$$\beta_{2j} = \gamma_{20} + \gamma_{21}\text{School\_Rank}_j + u_{2j}$$

The results of the full random coefficient models are found in tables 51 through 56. Recall that it was decided a priori that in order for the variation in the level 2 gender slopes to be considered important both the test of significance and the deviance test would have had to agree. First, the *p*-values for the estimation of the random components of the full models showed that there was significant variation in the sex slopes for English and Science only, but not math. Therefore, the sex effect in math was considered to be fixed without having to perform a deviance test on the random component for the

sex slope. When predicting math progress, the contextual effect for sex was significant (t (628) = 2.15, p = .032) indicating that schools with higher proportions of females tend to have higher math intercepts. The cross-level interaction term though was not significant (t (629) = -.428, p = .668).

Table 51

Random Coefficient Model for Math Achievement

Random Effect	Standard Deviation	Variance Component	Df	Chi-square	*p*-value
INTRCPT1, U0	1.32	1.74	537	2225.1	0.00
SEX slope, U1	0.34	0.11	538	578.3	0.11
level-1, R	3.41	11.65			
Fixed Effect	**Coefficient**	**Standard Error**	***T*-ratio**	**Approx d.f.**	***p*-value**
INTRCPT2, γ 00	35.5	0.061	578.4	628	0.00
SEX_100, γ 01	0.02	0.003	2.15	628	0.03
MATH_1_M, γ 02	0.48	0.025	63.4	628	0.00
For SEX slope, B1					
INTRCPT2, γ 10	0.22	0.068	5.14	629	0.00
SCHOOL_R, γ 11	0.00	0.001	-0.428	629	0.67
Math_1 slope, B2	0.82	0.008	172.6	12965	0.00
INTRCPT2, γ 20					
Deviance Statistic (df = 10)	69553.4				

Table 52

Reduced Random Coefficient Model for Math Achievement

Random Effect	Standard Deviation	Variance Component	Df	Chi-square	*p*-value
INTRCPT1, U0	1.32	1.74	628	2536.2	.00
level-1, R	3.42	11.68			
Fixed Effect	**Coefficient**	**Standard Error**	***T*-ratio**	**Approx d.f.**	***p*-value**
INTRCPT2, γ 00	35.5	0.061	578.4	628	.000

SEX_100, γ 01	0.16	0.003	2.16	628	.031
MATH_1_M, γ 02	0.48	0.025	63.4	628	.000
For SEX slope, B1, INTRCPT2, γ 10	0.22	0.068	5.16	12966	.000
Math_1 slope, B2 INTRCPT2, γ 20	0.82	0.008	172.6	12965	.000
Deviance Statistic (df = 7)	69554.6				

Next, models comparisons testing the significance of the random components for the sex slopes for English and Science were carried out. For English, the deviance statistic test results showed that the variation in the slopes was borderline not-significant (χ^2 (2) = 5.87 p = .0531). Since the p-value was borderline, the random component of the sex slopes was retained. There was a contextual effect for sex (t(628) = 2.02, p = .044), though no significant cross-level interaction between School Rank and sex (t(629) = .230, p = .831). That is, schools with higher proportion of females tend to have higher English intercepts, but School Rank did not moderate the effect sex had on the intercept.

For Science, the p- value for the main effect of sex was borderline not-significant (t (629) = 1.91, p = .056) suggesting that the main sex effect was not as pronounced for this subject as it was for math (t(629) = 5.14, p < .001) and English (t(629) = 11.3, p < . 001). (The main sex effect here is much smaller compared to the above results for Science achievement in Table 34, though the difference can be explained by the fact that for this method, group mean centering was employed, however for Table 34, grand mean centering was employed. Therefore, being a girl within a certain group has less of an effect on science achievement compared to being female on the overall average for science.) There was no contextual effect for sex (t(628) = 1.04, p = .302). The deviance statistics for the reduced model showed that it was not necessary to retain the random component for the sex slopes nor the cross level interaction term (χ^2 (3) = 5.20 p = .1578)

Table 53

Random Coefficient Model for English Achievement

Random Effect	Standard Deviation	Variance Component	Df	Chi-square	*p*-value
INTRCPT1, U0	1.51	2.27	537	3022.8	.00
SEX slope, U1	0.55	0.31	538	640.8	.002
level-1, R	3.11	9.70			
Fixed Effect	**Coefficient**	**Standard Error**	***T*-ratio**	**Approx d.f.**	***p*-value**
INTRCPT2, γ 00	33.1	0.061	578.4	628	.000
SEX_100, γ 01	0.02	0.003	2.16	628	.031
ENG_1_ME, γ 02	0.47	0.037	35.8	628	.000
For SEX slope, B1, INTRCPT2, γ 10	0.06	0.065	11.3	629	.000
SCHOOL_R, γ 11	0.00	0.001	.230	629	.818
ENG_1 slope, B2 INTRCPT2, γ 20	0.74	0.009	119.2	12965	.000
Deviance Statistic (df = 10)	67452.9				

Table 54

Reduced Random Coefficient Model for English Achievement

Random Effect	Standard Deviation	Variance Component	Df	Chi-square	*p*-value
INTRCPT1, U0	1.51	2.27	537	3023.0	.00
SEX slope, U1	0.56	0.31	539	640.9	.002
level-1, R	3.11	9.70			
Fixed Effect	**Coefficient**	**Standard Error**	***T*-ratio**	**Approx d.f.**	***p*-value**
INTRCPT2, γ 00	33.1	0.067	496.2	628	.000
SEX_100, γ 01	0.02	0.004	2.02	628	.044
ENG_1_ME, γ 02	0.47	0.037	35.8	628	.000
For SEX slope, B1, INTRCPT2, γ 10	0.06	0.065	11.4	630	.000
ENG_1 slope, B2 INTRCPT2, γ 20	0.74	0.009	119.2	12965	.000
Deviance statistic (df = 9)	67453.0				

Table 55

Random Coefficient Model for Science Achievement

Random Effect	Standard Deviation	Variance Component	Df	Chi-square	*p*-value
INTRCPT1, U0	1.58	2.49	537	2301.8	.00
SEX slope, U1	0.47	0.22	538	605.1	.023
level-1, R	3.84	14.7			
Fixed Effect	**Coefficient**	**Standard Error**	***T*-ratio**	**Approx d.f.**	***p*-value**
INTRCPT2, γ 00	32.9	0.072	456.7	628	.000
SEX_100, γ 01	0.01	0.004	1.035	628	.302
SCI_1_ME, γ 02	0.48	0.052	30.9	628	.000
For SEX slope, B1, INTRCPT2, γ 10	0.01	0.076	1.91	629	.056
SCHOOL_R, γ 11	-0.01	0.001	-1.41	629	.158
SCI_1 slope, B2	0.57	0.012	102.1	12965	.000
INTRCPT2, γ 20					
Deviance Statistic (df = 10)	72669.6				

Table 56

Reduced Random Coefficient Model for Science Achievement

Random Effect	Standard Deviation	Variance Component	Df	Chi-square	*p*-value
INTRCPT1, U0	1.58	2.49	628	2747.4	.00
level-1, R	3.84	14.8			
Fixed Effect	**Coefficient**	**Standard Error**	***T*-ratio**	**Approx d.f.**	***p*-value**
INTRCPT2, γ00	32.9	0.072	456.7	628	.000
SEX_100, γ 01	0.01	0.004	1.02	628	.310
SCI_1_ME, γ 02	0.48	0.052	30.9	628	.000
For SEX slope, B1, INTRCPT2, γ 10	0.01	0.076	1.91	12966	.052
SCI_1 slope, B2	0.57	0.012	102.2	12966	.000
INTRCPT2, γ 20					
Deviance Statistic (df = 7)	72674.7				

Overall although the u_{ij} for English and Science were significant, further examination of the necessity for retaining the random components for the sex slopes revealed that this variation was not important enough to model for Science, but perhaps it was for English. Thus, the level 1 gender effect was considered to be consistent across the schools for Science and Math but slightly varying for English. This level 1 gender effect however was not moderated by School Rank, therefore School Rank does not appear to be an important predictor of level 1 sex slopes. There was a significant contextual effect for gender at level 2, with schools with higher proportions of females tending to have higher Math and English averages.

Consequently, schools that had an estimate of zero effect for their sex slopes for the model predicting progress in English were selected to determine in future descriptive analysis whether any of these schools had boys' averages at least one standard deviation above the grand boys' mean. The empirical bayes residuals of the sex slopes ranged from -.549 to .635 with a Mean = 0 and SD = .190. In total, there were 4 schools with sex slopes estimated to be zero, however these were either all boys or all girls schools. Therefore, none of the mixed gender schools had a sex effect of zero. There were 55 mixed gender schools with a sex slope close to zero (that is 0 ±.02) and these were considered for further analysis.

Question 3.2. Are there any schools in which boys perform well?

Models 42-44

Random intercepts models predicting boys progress in Math, English and Science were examined.

$$KS3_{ij} = \gamma_{00} + \mu_{0j} + \beta_{1j}KS2_{ij} + r_{ij}$$

For math there were 82 schools in which the mean boys' score was at least one standard deviation above the boys' average (Group 1), nine schools in which they scored at least two standard deviations above boys average (Group 2), and a single school where

they scored at least three standard deviations above the boys' average (Group 3). For English, there were 69 schools in which the average boys' score was at least one standard deviation above the boys' average (Group 1), 19 schools in which the boys scored at least two standard deviations above the boys' average (Group 2), but no school in which the boys scored at least three standard deviations above the boys' average. For Science, there were 63 schools in which the boys' mean was at least one standard deviation above the boys' average (Group 1), 15 schools in which the boys scored at least two standard deviations above the boys' average (Group 2); and two schools that scored at least three standard deviations above the boys' average in science. The demographic make-up of the schools in Groups 1, 2 and 3 predicting Math achievement was more closely similar to Science than English. Descriptions of these schools in terms of gender, ethnic, SES, parent expectations, parent Aspirations, parent involvement, and help with homework can be found in Appendix III.

Of the 55 schools in which the sex slope predicting English achievement approaches zero, only nine of them were ones in which boys scored at least one standard deviation above the boys average in English. All of these schools belonged to Group 1.

Characteristics of these nine schools are found in Table 57. In general, these schools had very few students on free and reduced lunch, and at least one of them had a very diverse population with only 33% White majority. The parents tended to have high expectations and Aspirations for their children to attend tertiary education. Similar to the population average reported in Table 4, about 80% of the kids in these schools reported that they did not receive homework help at home, though on average, the parents reported being fairly involved with their child's school life.

Table 57

Descriptive Demographics of schools that have almost negligible sex effect and of which boys perform at least one standard deviation above the boys' overall average English at Key Stage 3

	N	Minimum	Maximum	Mean	Std. Deviation
Proportion of Females	173	134.78	166.67	148.68	9.68

Free School Meals	149	.00	.23	0.06	0.09
Proportion of Caribbean	173	.00	.07	0.01	0.03
Proportion of Mixed	173	.00	.08	0.02	0.03
Proportion of Indian	173	.00	.37	0.07	0.14
Proportion of Pakistani	173	.00	.17	0.04	0.06
Proportion of Bangladeshi	173	.00	.07	0.01	0.03
Proportion of White	173	.33	1.00	0.82	0.24
Proportion of African	173	.00	.03	0.01	0.02
Proportion of Other	173	.00	.15	0.02	0.04
Parents Involvement_mean	173	2.77	3.10	2.95	0.10
Parent's Desire_mean	173	.88	1.00	0.93	0.05
Parent Expect _mean	173	.77	.96	0.90	0.06
Help with HW at home_mean	173	.79	1.00	0.89	0.06

Research Questions 4

Is the difference in academic progress between boys and girls of Caribbean descent moderated by any attitudinal or behavioral factors related to academic achievement?

Research Question 4 was addressed by fitting the full models outlined below. Predictors included in the models were the attitudinal and behavioral factors examined in Research Question 1. The final reduced model that was selected was the one that was simplest in form but that explained the same amount of variation as the full model. To arrive to the most parsimonious model, backward elimination was employed by removing all non-significant predictors in a single step.

It is important to note that a major limitation in addressing Research Questions 4 was sample size. Recall that in the LSYPE database, there were missing data on almost all of the variables. Furthermore, the Caribbean group along with other ethnic minority groups had higher non-response rates over time. Research Questions 4 had a sample size of 338 because this was the number of Caribbean students who had data on all variables of interest. Therefore, to determine the extent to which the 338 was representative of all the Caribbean students in the database, the final model selected was applied to the entire sample of Caribbean students to see whether the attitudinal and behavioral predictors that were important to the n = 338 were also important in the larger group.

Models 45 through 47 were used to address Research Question 3 for Math and English and Science.

Model 45

$KS3\_Math_i = \beta_0 + \beta_1 KS2\_Math_i + \beta_2 SES_i + \beta_3 Sex_i + \beta_4 Academic\_Self\_Concept_i + \beta_5 Parent\_Aspir_i + \beta_6 Parent\_Exp_i + \beta_7 ParentInvolvement1_i + \beta_8 ParentInvolvement2_i + \beta_9 ParentInvolvement3_i + \beta_{10} StudySupport_i + \beta_{11} Attitude_i + \beta_{12} MentalHealth_i + \beta_{13} RiskyBehavior_i + \beta_{14} Discrimination_i + \beta_{15} Academic\_Self\_Concept_i * Sex_i + \beta_{16} Parent\_Aspir_i * Sex_i + \beta_{17} Parent\_Exp_i * Sex_i + \beta_{18} ParentInvolvement1_i * Sex_i + \beta_{19} ParentInvolvement2_i * Sex_i + \beta_{20} ParentInvolvement3_i * Sex_i + \beta_{21} StudySupport_i * Sex_i + \beta_{22} Attitude_i * Sex_i + \beta_{23} MentalHealth_i * Sex_i + \beta_{24} RiskyBehavior_i * Sex_i + \beta_{25} Discrimination_i * Sex_i + r_i$

Model 46

$KS3\_English_i = \beta_0 + \beta_1 KS2\_English_i + \beta_2 SES_i + \beta_3 Sex_i + \beta_4 Academic\_Self\_Concept_i + \beta_5 Parent\_Aspir_i + \beta_6 Parent\_Exp_i + \beta_7 ParentInvolvement1_i + \beta_8 ParentInvolvement2_i + \beta_9 ParentInvolvement3_i + \beta_{10} StudySupport_i + \beta_{11} Attitude_i + \beta_{12} MentalHealth_i + \beta_{13} RiskyBehavior_i + \beta_{14} Discrimination_i + \beta_{15} Academic\_Self\_Concept_i * Sex_i + \beta_{16} Parent\_Aspir_i * Sex_i + \beta_{17} Parent\_Exp_i * Sex_i + \beta_{18} ParentInvolvement1_i * Sex_i + \beta_{19} ParentInvolvement2_i * Sex_i + \beta_{20} ParentInvolvement3_i * Sex_i + \beta_{21} StudySupport_i * Sex_i + \beta_{22} Attitude_i * Sex_i + \beta_{23} MentalHealth_i * Sex_i + \beta_{24} RiskyBehavior_i * Sex_i + \beta_{25} Discrimination_i * Sex_i + r_i$

Model 47

$KS3\_Science_i = \beta_0 + \beta_1 KS2\_Science\ \beta_2 SES_i + \beta_3 Sex_i + \beta_4 Academic\_Self\_Concept_i + \beta_5 Parent\_Aspir_i + \beta_6 Parent\_Exp_i + \beta_7 ParentInvolvement1_i + \beta_8 ParentInvolvement2_i + \beta_9 ParentInvolvement3_i + \beta_{10} StudySupport_i + \beta_{11} Attitude_i + \beta_{12} MentalHealth_i + \beta_{13} RiskyBehavior_i + \beta_{14} Discrimination_i + \beta_{15} Academic\_Self\_Concept_i * Sex_i + \beta_{16} Parent\_Aspir_i * Sex_i + \beta_{17} Parent\_Exp_i * Sex_i + \beta_{18} ParentInvolvement1_i * Sex_i +$

$\beta_{19}ParentInvolvement2_i*Sex_i + \beta_{20}ParentInvolvement3_i*Sex_i + \beta_{21}StudySupport_i*Sex_i + \beta_{22}Attitude_i*Sex_i + \beta_{23}MentalHealth_i*Sex_i + \beta_{24}RiskyBehavior_i*Sex_i + \beta_{25}Discrimination_i*Sex_i + r_i$

Models 45-47: Math, English and Science achievement for Caribbean Students

The results for Models 45-57 are presented in Tables 58 through 60. The final reduced model predicting progress in Math was successful in accounting for the girl advantage in Math. This reduced model demonstrated that the attitudes and behaviors important in moderating the girl advantage in math were Academic Self Concept (t_{325} = -2.18, p = .030), the interaction between Sex*Parent Involvement3 (t_{325} = 2.14, p = .050); and the interaction between Sex* Risky Behavior (t_{325} = 2.00, p = .046). Demographic variables that were also important were Prior Math Achievement (t_{325} = 80.8, p < .001) and SES (t_{325} = -2.14, p = .033).

The final model predicting progress in Math can be interpreted as follows: when controlling for KS2_Prior Math Achievement, SES, Sex, Parent Involvement, the interaction between Sex * Parent Involvement, Risky Behavior, and the interaction between Sex * Risky Behavior; as Academic Self Concept decreases in Caribbean students, so does their progress in Math Achievement. When controlling for KS2_Prior Math Achievement, SES, Sex, Risky Behavior, the interaction between Sex and Risky Behavior, and Academic Self Concept, girls whose parents are more involved tend to make more progress in math. Also, the significant interaction term Sex*Risky Behavior suggests that when controlling for all the other above variables, as girls' Risky Behavior increases so does their progress in Math (Figure 15). Finally, students who had higher KS2 achievement scores tended to make more progress in Math, and students who received free school meals tended to make less progress in math, as would be expected.

The final reduced model predicting progress in English included Academic Self Concept (t_{332} = -5.30, p < .001) and Parent Desire for child to go to tertiary education (t_{332} =3.40, p < .001). Unlike the model predicting math achievement, this one was not

successful in eliminating the girl advantage in English. Demographic variables that were also important for explaining variation in English progress were Prior English Achievement (t_{332} = 176.1, p < .001), Sex (t_{332} = -2.75, p = .006) and SES (t_{332} = -2.24 p = .026) This reduced model demonstrated that when controlling for Prior English Achievement, Sex, and Academic Self Concept, parents who wanted their children to go to tertiary education had children who made more progress in English. Also, when controlling for Prior English Achievement, Sex, and Parent Aspirations, as Academic Self Concept decreases, so does their progress in English.

The final reduced model predicting progress in Science included Prior Science Achievement (t_{333} = 17.6, p < .001), SES (t_{333} = -2.47, p = .014), Sex (t_{333} = 2.12, p = .035), and Self-Concept (t_{333} = -4.29, p = <.001). The model can be interpreted as follows: after controlling for Prior Science Achievement, SES, and Sex, as Caribbean students Academic Self Concept decreases, so does their progress in Science.

Table 58

Moderators of Progress in Math Achievement: Caribbean Students

	Full Model: Math			Reduced Model Math		
Fixed effects:	Estimate	Std. Error	t value	Estim -ate	Std. Error	t value
(Intercept)	34.56	0.46	75.56***	34.76	0.43	80.87***
Math_1	1.30	0.05	25.54***	1.31	0.05	25.84***
SES	-1.17	0.55	-2.13*	-1.15	0.54	-2.14*
Sex_Cent	-0.21	0.89	-0.23	0.21	0.84	0.25
Parent Expectations	1.09	0.96	1.13			
Parent Aspirations	1.51	1.23	1.23			
ParInvolv1	-0.58	1.10	-0.53	-0.37	1.07	-0.35
ParInvolv2	-0.07	0.87	-0.07	-0.28	0.85	-0.34
ParInvolv3	-0.27	0.55	-0.49	-0.16	0.54	-0.29
W1hwhelp	0.40	0.52	0.78			
Self_Con	-0.55	0.31	-1.77.	-0.60	0.28	-2.18*
Attitude_1	-0.23	0.30	-0.79			
Risky_1	-0.24	0.29	-0.84	-0.20	0.27	-0.73
Discrimination2	-0.48	0.31	-1.56			
Poor_Health	0.23	0.24	0.95			

Sex_Cent:Parent Expectation_Exp	0.11	1.94	0.06			
Sex_Cent:Parent Aspirations_Desire	-0.70	2.47	-0.28			
Sex * ParInvolv1	2.44	2.67	1.13	2.07	2.11	0.99
Sex * ParInvolv2	-1.84	1.73	-1.06	-1.54	1.69	-0.91
Sex *ParInvolv3	2.10	1.10	1.91.	2.11	1.07	1.97.
Sex_Cent:W1hwhelp	-0.75	1.03	-0.73			
Sex_Cent:Self_Con	0.76	0.58	1.32			
Sex_Cent:Attitud1	0.55	0.59	0.92			
Sex_Cent:Risky_1	1.04	0.58	1.80.	1.08	0.54	2.00*
Sex_Cent:Discrimination2	-0.42	0.61	-0.68			
Sex_Cent:Poor_Health	0.68	0.48	1.42			
Df		312			325	
Adj. R^2		.732			.729	
$F_{(25,312)}$ & $F_{(12,325)}$		37.7			76.7	
p-value		<.001			<.001	
χ^2 Statistic					1.1975	
Df					13	
p-value					.280	
Decision					Keep Reduced	

Note. '.' $p < .10$, * $p < .05$ ** $p < .01$, *** $p < .001$

Interaction plots were made for Sex* Risky behavior and Sex* Parent Involvement regressed on Math achievement at Key Stage 3 (Figures 15 and 16). As indicated by the regression results, boys who exhibit more risky behavior tend to have lower scores, whereas girls who exhibit more risky behavior tend to have higher math scores. Likewise, the interaction plot of the interaction term between Sex* Parent Involvement in Figure 16 suggest that in general, Caribbean parents who are increasingly more involved with their boys' school life tend to have sons who perform at a lower level in math. Conversely, Caribbean parents who are increasingly more involved with the daughter's school life tend to have girls who perform at a slightly higher level in math.

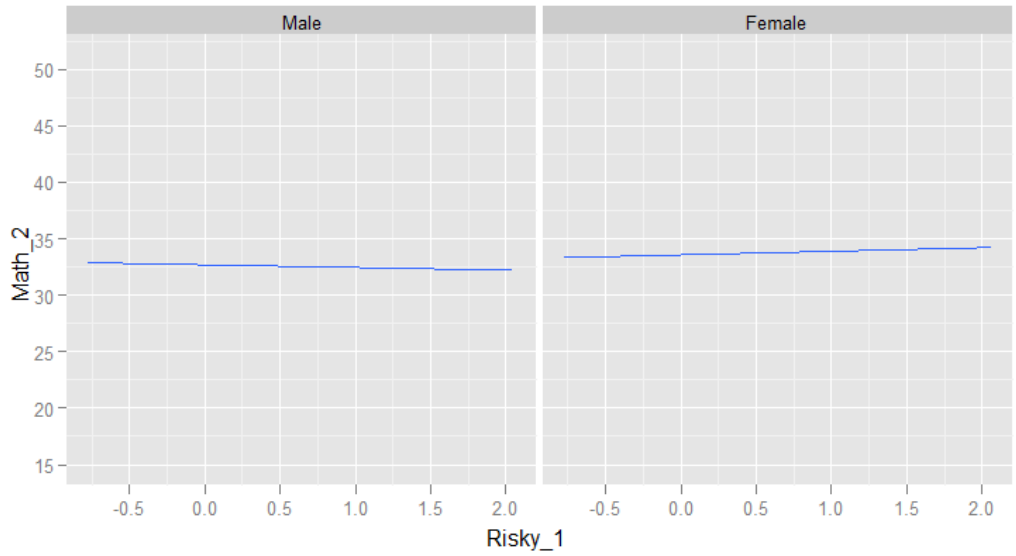


Figure 15. Plot of Interaction between Sex*Risky Behavior on progress in Math

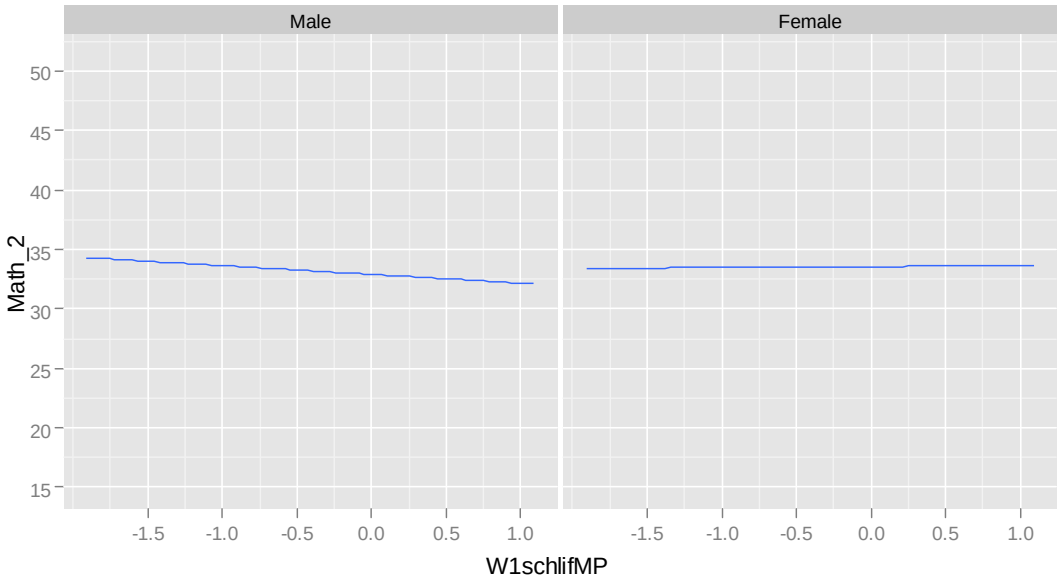


Figure 16. Plot of Interaction between Sex*Parent Involvement on progress in Math

Table 59

Moderators of Progress in English Achievement: Caribbean Students

	Full Model: English			Reduced Model English		
Fixed effects:	Estimate	Std. Error	t value	Estimate	Std. Error	t value
(Intercept)	32.2	0.40	81.44***	32.6	0.19	176.1***
Eng_1	0.85	0.05	17.61***	0.86	0.05	18.71***
SES	-1.15	0.49	-2.37*	-1.05	0.47	-2.24*
Sex_Cent	0.25	0.79	0.32	1.02	0.37	2.75**
Parent Expectation	0.15	0.84	0.18			
Parent Aspirations	3.43	1.07	3.20**	3.23	0.95	3.40***
ParInvolv1	1.21	0.95	1.27			
ParInvolv2	-1.01	0.76	-1.34			
ParInvolv3	-0.03	0.48	-0.07			
W1hwhelp	-0.11	0.45	-0.25			
Self_Con	-1.31	0.26	-5.01***	-1.20	0.23	-5.30***
Attitude_1	-0.34	0.26	-1.33			
Risky_1	-0.42	0.25	-1.66			
Discrimination2	-0.21	0.27	-0.80			
Poor_Health	0.25	0.21	1.19			
Sex_Cent:Parent Expect	0.05	1.68	0.03			
Sex_Cent:Parent Aspirations	2.45	2.14	1.14			
Sex * ParInvolv1	1.43	1.89	0.76			
Sex * ParInvolv2	-0.50	1.51	-0.33			
Sex *ParInvolv3	0.20	0.95	0.21			
Sex_Cent:W1hwhelp	1.14	0.90	1.27			
Sex_Cent:Self_Con	-0.19	0.50	-0.39			
Sex_Cent:Attitud1	-0.86	0.51	-1.67			
Sex_Cent:Risky_1	-0.38	0.50	-0.77			
Sex_Cent:Discrimination2	-0.72	0.53	-1.35			
Sex_Cent:Poor_Health	-0.22	0.41	-0.54			
Df		312			332	
Adj. R^2		.644			.645	
$F_{(25,312)}$ & $F_{(5,332)}$		25.42			123.6	
p-value		<.001			<.001	
χ^2 Statistic					.957	
Df					20	

p-value	.514
Decision	Keep reduced

Table 60

Moderators of Progress in Science Achievement: Caribbean Students

	Full Model: Math			Reduced Model Math		
Fixed effects:	Estimate	Std. Error	t value	Estimate	Std. Error	t value
(Intercept)	31.43	0.499	62.97	31.63	0.229	137.87***
Sci_1	1.14	0.070	16.41	1.17	0.067	17.55***
SES	0.35	0.988	0.36	-1.43	0.578	-2.47*
Sex_Cent	0.23	1.058	0.20	0.96	0.455	2.12*
Parent Expectation	1.74	1.363	1.28			
Parent Aspirations	0.13	1.207	0.10			
ParInvolv1	-0.59	0.960	-0.61			
ParInvolv2	-0.02	0.608	-0.04			
ParInvolv3	0.27	0.568	0.48			
W1hwhelp	-1.27	0.327	-3.88			
Self_Con	-0.44	0.326	-1.33	-1.20	0.281	-4.29***
Attitude_1	-0.30	0.317	-0.95			
Risky_1	-0.219	0.335	-0.653			
Discrimination2	0.087	0.263	0.33			
Poor_Health	-3.397	2.132	-1.593			
Sex_Cent:Parent Expectation	4.369	2.719	1.607			
Sex_Cent:Parent Aspirations	1.397	2.390	0.585			
Sex * ParInvolv1	-0.390	1.908	-0.204			
Sex * ParInvolv2	0.826	1.208	0.684			
Sex *ParInvolv3	-1.594	1.136	-1.403			
Sex_Cent:W1hwhelp	-0.009	0.633	-0.015			
Sex_Cent:Self_Con	0.057	0.652	0.088			
Sex_Cent:Attitud1	0.335	0.636	0.526			
Sex_Cent:Risky_1	-0.497	0.675	-0.735			
Sex_Cent:Discrimination2	0.274	0.523	0.524			
Sex_Cent:Poor_Health	31.43	0.499	62.973			
Df		312			333	
Adj. R^2		.550			.557	

$F_{(25,312)}$ & $F_{(4,333)}$	17.45	106.8
p-value model	<.001	<.001
χ^2 Statistic		.755
Df		21
p-value		.774
Decision		Keep Reduced

Sensitivity Analysis

The final models selected for progress in Math, English and Science were applied to the larger sample of Caribbean students to verify whether or not these predictors were also important in this group as well (Tables 61- 63). In keeping with the results of the smaller sample, the predictors that were important for Math and English on the sample of n = 338 were also important in the larger group. Further, in the larger sample, the interaction term between Sex*Parent Inovlvment2 was also significant for the model predicting progress in Math, though the sign was negative suggesting that Parent involvement may not share a linear relationship with progress in Math. Finally, in the larger sample, the girl advantage in math and science was not statistically significant, though it was borderline for science (t(489) = 1.85, p = .065). In English, however, the girl advantage remained robust. Overall, the congruency between the models applied to the n = 388 and n ≈ 470 demonstrates that the sample of n = 338 were representative of the larger sample on these factors.

Table 61

Sensitivity Analysis for Caribbean Math Achievement

	Estimate	Std. Error	t value
(Intercept)	34.9	0.365	95.70***
Math_1	1.29	0.040	32.01***
SES	-0.90	0.432	-2.08*
Sex_Cent	-0.43	0.709	-0.61
ParInvolv1	-1.60	0.903	-1.78
ParInvolv2	0.57	0.716	0.80

ParInvolv3	-0.27	0.458	-0.59
Self_Con	-0.89	0.228	-3.90***
Risky_1	-0.29	0.224	-1.30
Sex * ParInvolv1	3.51	1.785	1.97*
Sex * ParInvolv2	-3.24	1.419	-2.28*
Sex *ParInvolv3	2.76	0.909	3.04**
Sex_Cent:Risky_1	0.99	0.444	2.23*
Df		466	
Adj. R^2		.741	
$F_{(12,466)}$		114.9	
p-value		2.2e-16	

Table 62

Sensitivity Analysis for Caribbean English Achievement

	Estimate	Std. Error	t value
(Intercept)	32.6	0.016	202.4***
Eng_1	0.88	0.038	23.3***
SES	-0.63	0.383	-1.65
Sex_Cent	1.09	0.316	3.45***
Parent Aspirations	2.64	0.834	3.16**
Self_Con	-1.25	0.191	-6.53***
Df		467	
Adj. R^2		.661	
$F_{(5, 467)}$		184.9	
p-value		2.2e-16	

Table 63

Sensitivity Analysis for Caribbean Science Achievement

	Estimate	Std. Error	t value
(Intercept)	31.5	0.200	157.8***
Sci_1	1.16	0.054	21.6***
SES	-1.29	0.475	-2.72**
Sex_Cent	0.72	0.390	1.85.
Self_Con	-1.19	0.237	-5.03***

Df	489
Adj. R^2	.557
$F_{(4,489)}$	155.8
p-value	2.2e-16

In summary, the data was able to demonstrate moderators of the girl advantage in Math and Science but not English. The data also demonstrated that the only attitudinal/behavioral factor that was consistently important amongst Caribbean students was Academic Self-Concept. Parent Involvement, Parent Aspirations, and Young Person's Risky Behavior to some extent might be noteworthy as well.

Research Question 5

When controlling for school environment, are attitudinal and behaviors factors still important for predicting academic progress amongst boys and girls of Caribbean descent?

To address this question, final reduced models 32 – 34 selected from Research Question 4 where modeled with the inclusion of School Rank.

Model 48

$$KS3\_Math_i = \beta_0 + \beta_1 KS2\_Math_i + \beta_2 SES_i + \beta_3 Sex_i + \beta_4 Academic\_Self\_Concept_i + \beta_5 ParentInvolvement1_i + \beta_6 ParentInvolvement2_i + \beta_7 ParentInvolvement3_i + \beta_8 RiskyBehavior_i + \beta_9 ParentInvolvement1_i * Sex_i + \beta_{10} ParentInvolvement2_i * Sex_i + \beta_{11} ParentInvolvement3_i * Sex_i + \beta_{12} RiskyBehavior_i * Sex_i + \beta_{13} School\_Rank_i + r_i$$

Model 49

$$KS3\_English_i = \beta_0 + \beta_1 KS2\_English_i + \beta_2 SES_i + \beta_3 Sex_i + \beta_4 Academic\_Self\_Concept_i + \beta_5 Parent\_Exp_i + \beta_6 School\_Rank_i + r_i$$

Model 50

$KS3\_Science_i = \beta_0 + \beta_1 KS2\_Math_i + \beta_2 SES_i + \beta_3 Sex_i + \beta_4 Academic\_Self\_Concept_i + \beta_5 School\_Rank_i + r_i$

The results of these models are found in Table 64 and 65. These results demonstrated that the inclusion of School Rank did not reduce the importance of the attitudinal/behaviors factors that predicted Math, English, and Science achievement. Thus School Rank accounted for something other than what was captured in these attitudinal/behavioral factors.

Table 64

Important Moderators of Math and English Achievement after controlling for School environment: Caribbean Students

	Caribbean Math			Caribbean English		
	Estimate	Std Error	*t* value	Estimate	Std Error	*t* value
Intercept	34.8	0.359	97.0***	32.6	0.158	206.0***
KS2_Achievement	1.25	0.041	30.2***	0.82	0.039	21.1***
SES	-0.67	0.427	-1.58	-0.48	0.378	-1.23
Sex	-0.44	0.696	-0.63	1.11	0.311	3.58***
Parent_Aspiration				2.62	0.819	3.20***
Self_Con	-0.96	0.224	-4.30***	-1.31	0.189	-6.93***
ParInvolv1	-1.43	0.887	-1.61			
ParInvolv2	0.44	0.703	0.62			
ParInvolv3	-0.22	0.450	-0.49			
Risky	-0.23	0.221	-1.03			
Sex * ParInvolv1	3.14	1.72	1.79			
Sex * ParInvolv2	-3.12	1.39	-2.24*			
Sex *ParInvolv3	2.44	0.895	2.73**			
Risky*Sex	1.04	0.436	2.38*			
School Rank	0.01	0.002	4.41***	0.001	0.002	4.32***
Df		465			466	
Adj. R^2		.751			.673	
$F_{(13,465)}$ / $F_{(6,466)}$		111.8			163	
p-value		<.001			<.001	

Note. * $p < .05$, ** $p<.01$, *** $p <.001$

Table 65

Important Moderators of Science Achievement after controlling for School environment: Caribbean Students

	Caribbean Science		
	Estimate	Std Error	*t* value
(Intercept)	31.5	.194	162.1***
Sci_1	1.07	0.05	19.7***
SES	-0.96	0.47	-2.06*
Sex_Cent	0.63	0.38	1.66
Self_Con	-1.26	0.23	-5.44***
School_Rank	0.01	0.00	5.42**
Df		488	
Adj. R^2		.581	
$F_{(5,488)}$		137.8	
p-value		<.001	

Design Effect

The design effects for the fully unconditional models predicting math, English, and science achievement were calculated for each ethnic group. These results are found in Table 66 below. It is important to determine the size of the design effects on each of the standard errors that had a significant *t*-value associated with it. These results suggest that the significant main effect for sex in the Caribbean model predicting progress in science might not have been important because the adjusted standard error is larger and results in a non-significant *t*-value.

From Table 34, the original estimate for Sex = .801, SE = .402, *t*- value = 2.00. Design effect Adjusted estimate = .801, SE = .401*(1.50), *t*-value = 1.33.
All other significant main effect sex terms for parallel regression models regressing prior knowledge and sex onto KS3 achievement remained significant even after accounting for the design effect.

Table 66

Design Effect calculated based on the unconditional models predicting Math, English, and Science for each Ethnic Group

	KS 3 Content Area		
Ethnic Group	Math	English	Science
Caribbean	1.33	1.44	1.50
Mixed	1.12	1.18	1.15
Indian	1.69	1.72	1.63
Pakistani	1.30	1.60	1.47
Bangladeshi	1.10	1.20	1.14
African	1.24	1.51	1.24

Parallel analysis for White Students

The same analyses outlined above for Research Questions 4 and 5 were also performed on the white group, which was the majority group in England. These comparative analyses were conducted to determine the extent to which attitudes and behaviors important for predicting achievement amongst Caribbean students was also true for White students. This section merely describes the final models selected for the White group, but refrains from making parameter interpretations, since the White group was not the focus of this study. Not that random intercepts for school clusters are retained for the White group because their sample sizes in each cluster is large enough for such analyses to take place.

Research Questions 4

Is the achievement gap between White boys and girls moderated by any attitudinal or behaviors factors related to academic achievement?

Model 51

$KS3\_Math_{ij} = (\gamma_{00}+\mu_{0j}) + \beta_{1j}KS2\_Math_{ij} + \beta_{2j}SES_{ij} + \beta_{3j}Sex_{ij} + \beta_{4j}Academic\_Self\_Concept_{ij} + \beta_{5j}Parent\_Aspir_{ij} + \beta_{6j}Parent\_Exp_{ij} + \beta_{7j}ParentInvolvement1_{ij} + \beta_{8j}ParentInvolvement2_{ij} + \beta_{9j}ParentInvolvement3_{ij} + \beta_{10j}StudySupport_{ij} + \beta_{11j}Attitude_{ij} + \beta_{12j}MentalHealth_{ij} + \beta_{13j}RiskyBehavior_{ij} + \beta_{14j}Discrimination_{ij} + \beta_{15j}Academic\_Self\_Concept_{ij}*Sex_{ij} + \beta_{16j}Parent\_Aspir_{ij}*Sex_{ij} + \beta_{17j}Parent\_Exp_{ij}*Sex_{ij} + \beta_{18j}ParentInvolvement1_{ij}*Sex_{ij} + \beta_{19j}ParentInvolvement2_{ij}*Sex_{ij} + \beta_{20j}ParentInvolvement3_{ij}*Sex_{ij} + \beta_{21}StudySupport_{ij}*Sex_{ij} + \beta_{22j}Attitude_{ij}*Sex_{ij} + \beta_{23j}MentalHealth_{ij}*Sex_{ij} + \beta_{24j}RiskyBehavior_{ij}*Sex_{ij} + \beta_{25j}Discrimination_{ij}*Sex_{ij} + r_{ij}$

Model 52

$KS3\_English_{ij} = (\gamma_{00}+\mu_{0j}) + \beta_{1j}KS2\_English_{ij} + \beta_{2j}SES_{ij} + \beta_{3j}Sex_{ij} + \beta_{4j}Academic\_Self\_Concept_{ij} + \beta_{5j}Parent\_Aspir_{ij} + \beta_{6j}Parent\_Exp_{ij} + \beta_{7j}ParentInvolvement1_{ij} + \beta_{8j}ParentInvolvement2_{ij} + \beta_{9j}ParentInvolvement3_{ij} + \beta_{10j}StudySupport_{ij} + \beta_{11j}Attitude_{ij} + \beta_{12j}MentalHealth_{ij} + \beta_{13j}RiskyBehavior_{ij} + \beta_{14j}Discrimination_{ij} + \beta_{15j}Academic\_Self\_Concept_{ij}*Sex_{ij} + \beta_{16j}Parent\_Aspir_{ij}*Sex_{ij} + \beta_{17j}Parent\_Exp_{ij}*Sex_{ij} + \beta_{18j}ParentInvolvement1_{ij}*Sex_{ij} + \beta_{19j}ParentInvolvement2_{ij}*Sex_{ij} + \beta_{20j}ParentInvolvement3_{ij}*Sex_{ij} + \beta_{21}StudySupport_{ij}*Sex_{ij} + \beta_{22j}Attitude_{ij}*Sex_{ij} + \beta_{23j}MentalHealth_{ij}*Sex_{ij} + \beta_{24j}RiskyBehavior_{ij}*Sex_{ij} + \beta_{25j}Discrimination_{ij}*Sex_{ij} + r_{ij}$

Model 53

$KS3\_Science_{ij} = (\gamma_{00}+\mu_{0j}) + \beta_{1j}KS2\_Science_{ij} + \beta_{2j}SES_{ij} + \beta_{3j}Sex_{ij} + \beta_{4j}Academic\_Self\_Concept_{ij} + \beta_{5j}Parent\_Aspir_{ij} + \beta_{6j}Parent\_Exp_{ij} + \beta_{7j}ParentInvolvement1_{ij} + \beta_{8j}ParentInvolvement2_{ij} + \beta_{9j}ParentInvolvement3_{ij} + \beta_{10j}StudySupport_{ij} + \beta_{11j}Attitude_{ij} + \beta_{12j}MentalHealth_{ij} + \beta_{13j}RiskyBehavior_{ij} + \beta_{14j}Discrimination_{ij} + \beta_{15j}Academic\_Self\_Concept_{ij}*Sex_{ij} + \beta_{16j}Parent\_Aspir_{ij}*Sex_{ij} + \beta_{17j}Parent\_Exp_{ij}*Sex_{ij} + \beta_{18j}ParentInvolvement1_{ij}*Sex_{ij} + \beta_{19j}ParentInvolvement2_{ij}*Sex_{ij} + \beta_{20j}ParentInvolvement3_{ij}*Sex_{ij} + \beta_{21}StudySupport_{ij}*Sex_{ij} + \beta_{22j}Attitude_{ij}*Sex_{ij} + \beta_{23j}MentalHealth_{ij}*Sex_{ij} + \beta_{24j}RiskyBehavior_{ij}*Sex_{ij} + \beta_{25j}Discrimination_{ij}*Sex_{ij} + r_{ij}$

The results for Model 51 predicting White students progress in Math are presented in Table 53. The results demonstrated that the final model selected included Prior Math Achievement (t_{572} = 129.7 , p < .001), SES (t_{572} = -6.8, p < .001), Academic Self Concept (t_{572} = -14.0, p < .001), Parent Expectation (t_{572}= 7.9, p = <.001), Parent Aspiration (t_{572} = 3.00, p < .003), Attitude Towards School (t_{572} = 2.5, p = .013), Mental Health (t_{564} = 6.60, p < .001), Risky Behavior (t_{572} = -7.6, p < .001), Discrimination (t_{572} =2.4 , p =.017) and the interaction Sex* Parent Expectation (t_{572} = 1.8, p = .072). Similarly to the Caribbean model, this model was successful in eliminating the girl advantage in progress made in Math.

The results for Model 52 predicting progress in English achievement (Table 67) indicated that all of the main effects except Help with Homework were significant (Prior English Achievement (t_{570} = 88.4 , p < .001), SES (t_{570} = -5.00, p < .001), Academic Self Concept (t_{570}= -16.6, p < .001), Parent Expectation (t_{570}= 5.9 , p <.001), Parent Aspiration (t_{570}= 3.5, p < .001), Parent Invovlement2 (t_{570}= -2.1, p = .036); Parent Invovlement3 (t_{570}= 2.1, p = .036); Attitude Towards School (t_{570}= 3.2 , p =.002), Mental Health (t_{570}= 8.7, p < .001), Risky Behavior (t_{570}= -7.3, p < .001), Discrimination (t_{570}= -3.7 , p =). Sex (t_{570} = 7.4, p < .001). Similar to the Caribbean model, this too was unable to mitigate the girl advantage in English.

The results for Model 53predicting progress in Science (Table 68) indicated that all of the main effects except Help with Homework and Attitude Towards School were significant. In addition, the interaction terms Sex*Parent Expectation and Sex*Parent Aspiration were also significant. (Prior Science Achievement (t_{568}= 81.6 , p < .001), SES (t_{568}= -7.00, p < .001), Sex (t_{568}= 1.5, p = .134). Academic Self Concept (t_{568}= -23.6, p < .001), Parent Expectation (t_{568}= 8.0 , p <.001), Parent Aspiration (t_{568}= 2.9, p < . 004), Parent Invovlement3 (t_{568}= 2.6, p = .010); Mental Health (t_{568}= 9.2, p < .001), Risky Behavior (t_{568}= -10.8, p < .001), Discrimination (t_{568}= -5.6 , p <.001); Sex*Parent Expectation (t_{568}= 3.8, p < .001), Sex*Parent Aspiration (t_{568}= -2.1, p < .036). The interaction term Sex*Self Concept was borderline significant (t_{568}= 1.9, p = .058). Interestingly, these interaction terms suggested that girls whose parents expected them to go to tertiary education tended to have higher scores than their male counterparts, but

girls whose parents wanted them to go to tertiary education tended to have lower scores than their male counterparts. Similar to the model predicting math achievement, this final model also mitigated the girl advantage in Science.

The sensitivity analysis demonstrated that these models were also applicable to the larger sample of n ≈7100, thereby demonstrating that the sample of n = 6,719 were representative of the larger sample on these attitudes and behaviors. it is important to note that the main effect for Sex in the n ≈7100 sample was borderline significant (t_{581} = -1.9, p = .058) for the model predicting Science achievement. This indicates that all things equal on these covariates, girls might now have a disadvantage.

In summary, the attitudinal/behavioral factors that appeared to consistently predict achievement amongst White students were Parent Expectations, Parent Aspirations, Academic Self Concept, Young Person's Attitude Towards School, Young Person's Risky Behavior, and State of Mental Health. The demographic variable SES also consistently explained variation in achievement. Finally, the final reduced models predicting math and science achievement attenuated the girl advantage in Math and Science, but not English.

Table 67

Moderators of Progress in Math Achievement: White Students

	Full Model: Math			Reduced Model: Math		
Random Effects	Variance			Variance		
Level 2 Intercepts	1.5396			2.5982		
Level 1 Residuals	9.2813			8.3910		
Fixed effects:	Estimate	Std. Error	t value	Estimate	Std. Error	t value
(Intercept)	35.73	0.080	444.6***	35.70	0.069	520.5***
Prior KS2 Math achievement	1.27	0.010	129.2***	1.27	0.010	129.7***
SES	-1.01	0.145	-6.9***	-0.98	0.145	-6.8***
Sex_Cent	0.07	0.117	0.6	0.07	0.082	0.8
Parent Expectation	1.15	0.143	8.00***	1.13	0.142	7.9***
Parent Aspirations	0.42	0.170	2.4*	0.47	0.158	3.00*
ParInvolv1	-0.12	0.142	-0.9			
ParInvolv2	-0.03	0.113	-0.2			

ParInvolv3	0.10	0.076	1.3			
W1hwhelp	-0.12	0.109	-1.1			
Self_Con	-0.77	0.054	-14.1***	-0.76	0.054	-14.0***
Attitude_1	0.14	0.054	2.7*	0.13	0.054	2.5 *
Risky_1	-0.43	0.057	-7.6***	-0.43	0.057	-7.6 ***
Discrimination2	-0.13	0.053	-2.5*	-0.13	0.053	-2.4*
Poor_Health	0.30	0.046	6.6***	0.30	0.046	6.6***
Sex_Cent:Parent Expectation	0.64	0.283	2.3*	0.44	0.245	1.8
Sex_Cent:Parent Aspirations	-0.22	0.341	-0.7			
Sex * ParInvolv1	0.05	0.282	0.2			
Sex * ParInvolv2	0.02	0.226	0.1			
Sex *ParInvolv3	-0.22	0.153	-1.4			
Sex_Cent:W1hwhelp	-0.11	0.216	-0.5			
Sex_Cent:Self_Con	0.17	0.101	1.6			
Sex_Cent:Attitud1	0.01	0.108	0.1			
Sex_Cent:Risky_1	0.06	0.113	0.5			
Sex_Cent:Discrimination2	-0.01	0.105	-0.2			
Sex_Cent:Poor_Health	-0.08	0.091	-0.9			
N		6719			6719	
No. of Clusters		584			584	
AIC		34669			34655	
BIC		34860			34750	
Deviance		34613			34627	
χ^2 Statistic					14.145	
Df					14	
p-value					.439	
Decision				Keep reduced		

Table 68

Moderators of Progress in English Achievement: White Students

	Full Model: English			Reduced Model: English		
Random Effects	Variance			Variance		
Level 2 Intercepts	2.5982			2.5946		
Level 1 Residuals	8.3910			8.4035		
Fixed effects:	Estimate	Std. Error	t value	Estimate	Std. Error	t value

(Intercept)	33.2	0.090	369.5***	33.23	0.089	373.3***
Prior KS2 English Achievment	0.97	0.011	88.3***	0.97	0.011	88.4***
SES	-0.70	0.141	-5.00***	-0.70	0.140	-5.00***
Sex_Cent	0.66	0.112	5.9***	0.58	0.079	7.4***
Parent Expectation	0.80	0.137	5.8***	0.78	0.133	5.9***
Parent Aspirations	0.56	0.162	3.5***	0.52	0.150	3.5***
ParInvolv1	0.16	0.136	1.2	0.16	0.136	1.1
ParInvolv2	-0.22	0.108	-2.1*	-0.22	0.108	-2.1*
ParInvolv3	0.15	0.073	2.1*	0.15	0.073	2.1*
W1hwhelp	-0.11	0.104	-1.1			
Self_Con	-0.85	0.051	-16.5***	-0.85	0.051	-16.6***
Attitude_1	0.17	0.052	3.2**	0.16	0.052	3.2**
Risky_1	-0.41	0.055	-7.5***	-0.39	0.054	-7.3***
Discrimination2	-0.19	0.051	-3.7***	-0.19	0.051	-3.7***
Poor_Health	0.38	0.044	8.6***	0.38	0.044	8.7***
Sex_Cent:Parent Expectation	0.17	0.270	0.6			
Sex_Cent:Parent Aspirations	0.24	0.326	0.7			
Sex * ParInvolv1	-0.27	0.270	-1.0			
Sex * ParInvolv2	0.10	0.216	0.5			
Sex *ParInvolv3	0.07	0.147	0.5			
Sex_Cent:W1hwhelp	0.10	0.206	0.5			
Sex_Cent:Self_Con	0.10	0.097	1.00			
Sex_Cent:Attitud1	-0.12	0.103	-1.1			
Sex_Cent:Risky_1	0.01	0.108	0.1			
Sex_Cent:Discrimination2	-0.10	0.101	-1.0			
Sex_Cent:Poor_Health	0.00	0.087	0.0			
N		6719			6719	
No. of Clusters		584			584	
AIC		34669			34213	
BIC		34860			34322	
Deviance		34613			34181	
χ^2 Statistic					8.8089	
Df					12	
p-value					.719	
Decision	Keep Reduced					

Table 69

Moderators of Progress in Science Achievement: White Students

	Full Model: Science			Reduced Model: Science		
Random Effects	Variance			Variance		
Level 2 Intercepts	2.1134			2.1299		
Level 1 Residuals	11.1122			11.1311		
Fixed effects:	Estimate	Std. Error	t value	Estimate	Std. Error	t value
(Intercept)	33.22	0.091	365.1***	33.22	0.090	367.7***
Prior KS2 Science achievement	1.20	0.015	81.6***	1.20	0.015	81.6***
SES	-1.12	0.160	-7***	-1.11	0.159	-7.0 ***
Sex_Cent	-0.11	0.128	-0.9	-0.14	0.090	-1.5
Parent Expectation	1.22	0.157	7.8***	1.23	0.156	8.00***
Parent Aspirations	0.54	0.186	2.9**	0.54	0.186	2.9**
ParInvolv1	0.02	0.156	0.1	0.02	0.155	0.2
ParInvolv2	0.02	0.124	0.2	0.02	0.124	0.1
ParInvolv3	0.21	0.084	2.6**	0.22	0.084	2.6**
W1hwhelp	0.10	0.119	0.9			
Self_Con	-1.27	0.058	-21.7***	-1.26	0.058	-23.6***
Attitude_1	0.09	0.059	1.5			
Risky_1	-0.63	0.063	-10.1***	-0.64	0.062	-10.8***
Discrimination2	-0.29	0.058	-5***	-0.29	0.058	-5.6***
Poor_Health	0.47	0.050	9.4***	0.47	0.050	9.2***
Sex_Cent:Parent Expectation	1.07	0.310	3.4**	1.14	0.308	3.8***
Sex_Cent:Parent Aspirations	-0.81	0.374	-2.2*	-0.80	0.374	-2.1*
Sex * ParInvolv1	0.15	0.309	0.5			
Sex * ParInvolv2	0.29	0.247	1.2			
Sex *ParInvolv3	0.02	0.168	0.1			
Sex_Cent:W1hwhelp	0.26	0.237	1.1			
Sex_Cent:Self_Con	0.29	0.111	2.6*	0.18	0.097	1.9
Sex_Cent:Attitud1	0.15	0.118	1.3			
Sex_Cent:Risky_1	-0.12	0.124	-0.9			
Sex_Cent:Discrimination2	-0.03	0.115	-0.2			
Sex_Cent:Poor_Health	-0.06	0.099	-0.6			
N		6719			6719	
No. of Clusters		584			584	
AIC		35927			35920	

BIC	36118	36043
Deviance	35871	35884
χ^2 Statistic		10.806
Df		10
p-value		.189
Decision	Keep Reduced	

Note. * $p < .05$, ** $p<.01$, *** $p <.001$

Model Comparisons between Caribbean and White

Models predicting Caribbean student achievement were compared to the ones predicting White student achievement to determine the extent to which these two groups were similar. The results of this comparison found in Table70 demonstrated that most of the significant predictors important to the Caribbean students were also important to White students.

Table 70

Common significant predictors of achievement amongst Caribbean and White students.

	Number of Significant Predictors in the final Reduced Models		
	Caribbean	White	Significant predictors in common
	#	#	
Math	6	8	Prior Math achievement Young Person Academic Self Concept SES Young Person Risky Behavior Parent Involvement
English	4	13	Sex Prior English Achievement Young Person Academic Self Concept Parent Desire
Science	4	15	Prior Science Achievement SES Young Person Academic Self Concept

Note. * $p < .05$, ** $p<.01$, *** $p <.001$

Research Question 5

When controlling for school environment, are attitudinal and behaviors factors still important for predicting the achievement gap between White boys and girls?

To address this question, final reduced models 41-43 were selected from Research Question 3 with the inclusion of School Rank as a level 2 predictor.

Model 54

$$KS3\_Math_{ij} = (\gamma_{00} + \mu_{0j}) + \beta_{1j}School\_Rank_{ij+} \beta_{2j}KS2Math_{ij} + \beta_{3j}SES_{ij} + \beta_{4j}Sex_{ij} + \beta_{5j}Academic\_Self\_Concept_{ij} + \beta_{6j}Parent\_Aspir_{ij} + \beta_{7j}Parent\_Exp_{ij} + \beta_{8j}MentalHealth_{ij} + \beta_{9j}RiskyBehavior_{ij} + \beta_{10j}Discrimination_{ij} + \beta_{11j}Attitude_{ij} + r_{ij}$$

Model 55

$$KS3\_English_{ij} = (\gamma_{00} + \mu_{0j}) + \beta_{1j}School\_Rank_{ij+} \beta_{2j}KS2Math_{ij} + \beta_{3j}SES_{ij} + \beta_{4j}Sex_{ij} + \beta_{5j}Academic\_Self\_Concept_{ij} + \beta_{6j}Parent\_Aspir_{ij} + \beta_{7j}Parent\_Exp_{ij} + \beta_{8j}MentalHealth_{ij} + \beta_{9j}RiskyBehavior_{ij} + \beta_{10j}Discrimination_{ij} + \beta_{11j}Attitude_{ij} + \beta_{12j}ParentInvolvement1_{ij} + \beta_{13j}ParentInvolvement2_{ij} + \beta_{14j}ParentInvolvement3_{ij} + r_{ij}$$

Model 56

$$KS3\_Science_{ij} = (\gamma_{00} + \mu_{0j}) + \beta_{1j}School\_Rank_{ij+} \beta_{2j}KS2Math_{ij} + \beta_{3j}SES_{ij} + \beta_{4j}Sex_{ij} + \beta_{5j}Academic\_Self\_Concept_{ij} + \beta_{6j}Parent\_Aspir_{ij} + \beta_{7j}Parent\_Exp_{ij} + \beta_{8j}MentalHealth_{ij} + \beta_{9j}RiskyBehavior_{ij} + \beta_{10j}Discrimination_{ij} + \beta_{11j}Attitude_{ij} + \beta_{12j}ParentInvolvement1_{ij} + \beta_{13j}ParentInvolvement2_{ij} + \beta_{14j}ParentInvolvement3_{ij} + \beta_{15j}Parent\_Aspir*Sex_{ij} + \beta_{16j}Parent\_Exp*Sex_{ij} + \beta_{17j}Academic\_Self\_Concept_{ij}*Sex_{ij} + r_{ij}$$

The results of Models 54 through 56 are presented in Tables 71 and 72. The main effect of School Rank was significant in all three models. All of the other

attitudinal/behavioral factors remained significant in the three models indicating that School Rank accounted for something other than attitudes and behaviors. Finally, after controlling for these attitudes and behaviors, girls' now lagged behind boys in their progress made in Science achievement.

Table 71

Important Moderators of Math and English Achievement after controlling for School Rank: White Students

	Math			English		
Random Effects	Variance			Variance		
Level 2 Intercepts	1.0265			1.9297		
Level 1 Residuals	9.6338			8.5458		
Fixed Effects	Est	Std Error	*t* value	Est	Std Error	*t* value
Intercept	35.6	0.060	596.4***	33.2	0.080	412.4***
KS2_Achievement	1.27	0.010	132.7***	0.96	0.011	90.84***
SES	-0.86	0.137	-6.32***	-0.75	0.132	-5.66***
Sex	0.09	0.080	1.12	0.55	0.077	7.18***
Parent_Asp	1.07	0.135	7.88***	0.85	0.126	6.75***
Parent_Exp	0.49	0.152	3.24**	0.56	0.143	3.94***
Parent_ Involve_1				0.20	0.131	1.49
Parent_ Involve_2				-0.26	0.105	-2.47**
Parent_ Involve_3				0.15	0.071	2.09*
Self_Con	-0.71	0.052	-13.6***	-0.84	0.049	-16.9***
Attitude	0.11	0.052	2.16*	0.15	0.050	2.99**
Risky	-0.47	0.055	-8.6***	-0.39	0.053	-7.33***
Discrimination	-0.16	0.051	-3.19**	-0.21	0.049	-4.31***
Health	0.30	0.044	6.7***	0.38	0.043	8.93***
SchoolRank	0.01	0.001	12.4***	0.01	0.001	11.53***
Sex*Parent_Expect						
Sex*Parent_Asp						
Sex*Self_Conc						
N	7211			7173		
No. of Clusters	596			597		
AIC	37288			36264		
BIC	37391			36381		
Deviance	37258			36230		

Note. * $p < .05$, ** $p<.01$, *** $p <.001$

Table 72

Important Moderators of Science Achievement after controlling for School Rank: White Students

	Science		
Random Effects	Variance		
Level 2 Intercepts	1.3070		
Level 1 Residuals	11.4592		
Fixed Effects	Estimate	Std Error	*t* value
Intercept	33.1	0.080	416.7***
KS2_Achievement	1.17	0.014	82.52***
SES	-1.08	0.151	-7.17***
Sex	-0.17	0.087	-1.99*
Parent_Asp	1.25	0.149	8.36***
Parent_Exp	0.65	0.176	3.71***
Parent_ Involve_1	0.01	0.151	0.05
Parent_ Involve_2	-0.02	0.120	-0.15
Parent_ Involve_3	0.18	0.082	2.2*
Self_Con	-1.25	0.056	-22.2***
Attitude	0.10	0.057	1.75
Risky	-0.64	0.060	-10.3***
Discrimination	-0.29	0.056	-5.16***
Health	0.45	0.049	9.31***
SchoolRank	0.01	0.001	14.65***
Sex*Parent_Expect	1.04	0.293	3.54***
Sex*Parent_Asp	-0.40	0.355	-1.12
Sex*Self_Conc	0.22	0.094	2.37*
N	7173		
No. of Clusters	597		
AIC	38367		
BIC	38505		
Deviance	38327		

CHAPTER V: CONCLUSION

Overview

Presently in the English-speaking Caribbean, boys' underachievement at the K-12 level has been a topic of great concern. Since the 1990s, the English-speaking Caribbean has adopted the United Nations Education for All Initiative, and in response, has focused on improving education systems in terms of access, equity, efficiency, and quality. Qualitative studies focusing on boys' underachievement have raised the question as to whether this issue is situational and due to short-comings in Caribbean education systems or whether it is actually endemic to Caribbean culture. Quantitative studies addressing attitudes and behaviors that may contribute to Caribbean boy underachievement have been limited; therefore this study sought to address that gap and provide quantitative evidence that might explain the girl advantage amongst Caribbean students. In particular, by using data outside the Caribbean, this study lent itself to addressing the question of whether Caribbean boys' underachievement is situational or cultural. This study utilized the LSYPE database, a longitudinal study on a nationally representative sample of English youth that began in 2004 when the young people were about age 14 and in the 9th grade. This database was chosen because many English-speaking Caribbean islanders migrate to England due to current or past colonization relations with UK.

Five research questions were addressed in this dissertation. They were as follows:

1. How do students of Caribbean descent compare to students of other ethnic groups on identified attitudes and behaviors related to academic achievement?
2. Is the achievement gap between boys and girls prominent amongst students of Caribbean descent who reside outside of the Caribbean? If so, how does this gap compare to the gap between girls and boys of other ethnicities?
3. What types of schools, if any, may ameliorate the achievement gap between boys and girls of Caribbean descent?
4. Is the achievement gap between boys and girls of Caribbean descent moderated by any attitudes or behaviors related to academic achievement?

5. When controlling for school environment, are identified attitudes and behaviors still important for predicting the achievement gap between boys and girls of Caribbean descent?

Research Question 1 compared Caribbean students to the different ethnic groups in the LSYPE database on certain attitudes and behaviors identified by Caribbean studies as important for predicting achievement. These attitudes and behaviors were examined to gain direction as to whether or not these factors ought to be included in proceeding models predicting Caribbean student achievement. These attitudes and behaviors were Young Person's Attitude Towards School, Young Person's Risky Behavior, Young Person's Academic Self Concept, Young Person's Perceived Discrimination, Young Person's State of Mental Health, Homework Help at Home, Parent Expectations, Parent Aspirations, and Parent's Involvement with School life. Five of these factors were examined using growth curves (i.e. Young Person's Attitude Towards School, Young Person's Risky Behavior, Parent Expectations, Parent Aspirations, and Parent's Involvement with School life) because the data lent itself to such analyses. The remaining four were examined cross-sectionally. The growth curve analyses demonstrated that aside from Parent's Aspirations (which decreased) and Parent Involvement (which increased), the other attitudes and behaviors remained stable over time.

The results for Research Question 1 demonstrated that compared to other ethnic groups, Caribbean students were only different in four of the nine attitudes and behaviors, namely Attitude Towards school, levels of Risky Behavior, Academic Self-Concept, and Parent Involvement with School life. That is, compared to the other races, Caribbean students generally displayed less positive attitude towards school, had more risky behavior, and had lower academic self-concept, but had parents who perceived themselves has being more involved with their child's school life compared to parents from most other races.

Research Question 2 examined whether or not there was an achievement gap between boys and girls of Caribbean descent. Possible gaps between boys and girls of other ethnic groups were also explored. Student achievement scores in national Math, English and Science exams taken at the end of Key Stage 2 (6^{th} grade) and Key Stage 3

(9th grade) were examined. The results demonstrated that there indeed was a gap between Caribbean boys and girls at both time points, with the girls outperforming the boys in English and Math at Key Stage 2, but in all three content areas by Key Stage 3. A comparison of the effect sizes for the girl advantage at both time points demonstrates that in most cases, the gap between Caribbean girls and boys is larger than the gap between girls and boys from all other ethnic groups. Therefore, the Caribbean girls' advantage appears to persist even outside of the English-speaking Caribbean. The only other ethnic group that had a similar pattern of girl advantage was Black Africans. Thus, in the Asian and Mixed ethnic groups, the girls consistently outperformed boys in English only; but both sexes perform similarly in Math and Science. In the White group, boys outperformed girls in Math and had a borderline advantage in Science at Key Stage 2. By Key Stage 3, boys maintained a borderline advantage in Math but by this time their advantage in Science had disappeared.

Not only do Caribbean girls consistently outperform Caribbean boys, but they also progress more than boys in each of the content areas. That is, over time, the gap between Caribbean girls and boys widens. A similar progress trend is seen amongst the White and African groups with the girls progressing significantly more than the boys between Key Stages 2 and 3 in at least 2 of the three content areas. Nevertheless, it is only in the Caribbean group where the girls achieve more and progress more in all three content areas by Key Stage 3. This demonstrates that the achievement and progress patterns between Caribbean boys and girls are unique to this ethnic group.

Research Question 3 attempted to identify characteristics of schools that might ameliorate the achievement gap between boys and girls of Caribbean descent. Recall that a limitation of this analysis was that it included all boys, and not just Caribbean boys, merely because the sample sizes of Caribbean boys in each cluster were too small. The analysis was intended to pinpoint schools of these two characteristics: an overall gender gap of zero and an average boys' achievement of at least one standard deviation above the grand mean boys' average. If there were schools of such characteristics, then perhaps these might be ones in which Caribbean boys perform well in also. The results demonstrated that there were very few schools in which being a girl had no particular

advantage and closer inspection revealed that these schools were mostly single sex schools. These then were excluded from further analysis. Overall, there were no mixed schools (that is, schools in which the proportion of girls to boys were relatively equal) in which the girl advantage was eliminated. There were, however, 55 schools in which the girl advantage was close to zero, but this was only for predicting progress in English achievement.

When examining schools in which boys performed well, the results demonstrated that there were about 80 schools in each content area where boys performed at least one standard deviation above the overall boys' average. Since the girl advantage was only eliminated in models predicting English achievement, only the schools for which boys did well in English were selected for further analysis. Of the 55 schools in which the sex gap approached zero for predicting English, surprisingly only nine were ones in which boys performed at least one standard deviation above the boys' grand average in English. This suggested that schools that are more gender fair in English achievement are not necessarily ones in which boys do well. Hence, it is skeptical as to whether any (mixed) schools have the potential to ameliorate the achievement gap between boys and girls of Caribbean descent.

Research Question 4 explored attitudes and behaviors that may help explain why Caribbean girls are progressing more than boys. Nine interaction terms between Sex and attitudes/behaviors were modeled. These were Sex*Young Person Risky Behavior, Sex*Young Person Attitude Towards School, Sex*Young Person Academic Self Concept, Sex*Young Person state of Mental Health, Sex*Young Person Perceived Discrimination, Sex*Parent Expectations, Sex*Parent Desires, Sex*Parent Involvement, and Sex*Help with Homework at home. First, the only interaction terms that were significant were Sex*Risky Behavior and Sex* Parent Involvement, and yet still, only when predicting Math achievement. This suggested that in general there was no difference between Caribbean boys and girls on the majority of these attitudes and behaviors. The interaction term between Sex*Risky behavior was unexpectedly positive suggesting that girls with more Risky behavior tend to make more progress in Math.

Future mediators/moderators of the relationship between Risky Behavior*Sex ought to be explored to provide a more reasonable explanation for this observed relationship.

Likewise, the interaction term between Sex and the ordinal variable Parent Involvement unexpectedly was not linear with math achievement. That is, parents who reported being 'not very involved' and 'very involved' had girls who tended to score higher in math compared to boys whose parents who report 'not involved at all'. In contrast, parents who reported being 'fairly involved' had girls who tended to score lower in math compared to boys whose parents report not 'not involved at all'. This suggests that parent involvement has a differential effect on Caribbean student achievement and this effect is moderated by whether the student is a girl or a boy. Also, Caribbean girls whose parents report that they are 'not very involved' and 'very involved' might be characteristically different from girls whose parents report being 'fairly well involved' as indicated by the relationship between achievement and involvement being in opposite directions for these two groups.

The only main effect that was consistent in predicting achievement in each of the content areas was Academic Self-Concept. Caribbean students with lower academic self concept tended to have lower achievement. The other attitude/behavior that appeared to have a positive relationship with achievement was Parent Desires but this was only significant when predicting English achievement. Overall, however, the demographic and attitudinal/behavioral variables in the final selected models predicting achievement were able to account for the girl advantage in Math and Science, but not English. Future studies ought to include these variables to examine the extent to which the findings of Research Question 4 are robust amongst different samples of Caribbean students located elsewhere.

Finally, Research Question 5 examined whether attitudes and behaviors that were identified as important in predicting Caribbean achievement in Research Question 4 were still important after controlling for the school environment. The results confirmed that School Rank had a positive relationship with Caribbean student achievement. Also, the attitudes and behaviors that were identified as important when predicting achievement in Math, English, and Science for Research Question 4 remained robust even after

controlling for this contextual variable. This suggested that the relationship between school environment and attitudes/behaviors is orthogonal and both contextual and attitudinal/behavioral variables are important to model when examining the sex gap amongst Caribbean students.

How do these findings relate to other research?

To locate Caribbean students performance in general, Caribbean students are the lowest performance ethnic group in England (Gosai, 2009; Strand 2010; Strand 2007). Even after controlling for socio-economic, parental background, and other neighborhood factors, the achievement gaps at the 11th grade level between Whites and Caribbean students still persist. The fact that socio-economic, parental background, and other neighborhood factors account for the achievement gap between Whites and all other ethnic groups leaves the underachievement of Caribbean students a perplexing issue in England.

An interesting finding from the results of Research Question 1was that Caribbean parents perceived themselves as more involved that other parents, despite the fact that Caribbean students are the lowest performing ethnic group in the LSYPE database. This finding is in contrast to other research conducted in England which demonstrates that as parent involvement goes up, so does children academic achievement (Desforges & Abouchaar , 2003). Similarly, in the USA, Roopnarine, Krishnakumar, Metindogan, and Evans (2006) found that amongst English-speaking Caribbean immigrants, parent involvement with homework and parent contact with school were positively correlated with their kindergarten-aged child's social and academic performance.

Research Question 4 did demonstrate that amongst Caribbean girls, the interaction term between sex * parent involvement did not share a linear relationship with math achievement, and likewise amongst the White group, the main effect for parent involvement had a similar relationship with English achievement. The fact that this non-linear relationship appears in both the Caribbean and White group suggest that parents who report different levels of involvement may be involved for entirely different reasons.

For example, it is possible that some parents are more involved because they actually have the time and resources to contribute to their child's education. Conversely, some parents might be involved because of academic or behavioral problems displayed by their child.

The results of Research Question 1 also demonstrated that there were no mental health differences between Caribbean students and most other ethnic groups. Although none of the studies in the Caribbean examined the relationship between mental health and achievement, mental health was nevertheless explored in this study because a previous study in England showed that adult Caribbean immigrants had elevated risks for schizophrenia (Pinto, Ashworth, Jones, 2008). In corollary, one US study reported that amongst adult Caribbean immigrants, those who were second and third generation immigrants had higher risks of psychiatric disorders compared to recently-arrived Caribbean immigrants (Williams, Haile, Gonzales et al 2007). This dissertation though examined Young Person's perceived state of mental health and not actual measures of psychiatric disorders.

Findings from Research Question 2 suggest that girls' advantage might by endemic to Caribbean culture. Caribbean studies have been speculative as to when the achievement gap between boys and girls appear, though some studies there (but not all) suggest that by the end of primary education, the gap in favor of girls in English and Math is present. No data for Key Stage 1 (1^{st} to 3^{rd} grade) was accessible for this dissertation therefore it could not contribute to findings for early primary school. Strand (2010) however examined achievement data on a national cohort of primary school children in England and followed them from 2004 when these students were in Key Stage 1 (3^{rd} grade) to 2006 when these students were in Key Stage 2 (6^{th} grade). The results demonstrated that when predicting averaged reading/writing/math scores for the entire cohort, after controlling for age, ethnic group, entitlement to free school meals, special need services, and mobility, girls outperformed boys in grade 3 (Key Stage 1), but both sexes performed similarly at Key Stage 2. (Note here that this author averaged the content areas scores whereas this dissertation examined the content areas separately. Had content scores been averaged for this dissertation, a similar pattern at Key Stage 2 and 3

might have emerged. It would have been interesting to see the performance of these elementary boys and girls for the separate content areas at these early time points). These differences in performances at the early then later elementary stages indicated that boys caught up with the girls by later elementary, and in fact, had made more progress than girls between these two stages. In contrast, the cohort pattern for Caribbean students at Key Stage 2 was different. That is, at Key Stage 2, Caribbean girls had outperformed Caribbean boys in averaged achievement scores and in fact had made more progress than Caribbean boys between the early and later elementary stages. Taken together, Strand's study along with this dissertation suggests that Caribbean girl advantage might show up in late primary school.

The findings for Research Question 2 in this dissertation demonstrated that by the end of primary education the effect size for English was twice the size for Math. This is comparable to the effect sizes found in De Lisle (2005) study on elementary students at the 3rd and 5th grade levels in Trinidad (N = 52,284). That is, in the De Lisle study, the effect size for English in favor of girls was twice the effect size for math at the 3rd grade and 5th grade levels. Likewise, another Caribbean study (Baker-Henningham et al 2009) which included N = 1300 elementary Jamaican students showed that at the 6th grade level, the effect size in favor of girls was slightly larger in English than Math. In contrast though, a much smaller study of N = 169 6th grade Barbadians showed no significant difference between girls and boys in English and Math (Galler et al 2004).

Another interesting finding from Research Question 2 was that Black African girls shared a similar girl advantage over their male counterparts in all three content areas by Key Stage 3. According to Gosai's (2009) qualitative dissertation on the Black male experience in English schools, African/ Caribbean boys have been recorded as the lowest attaining students in England since the 1970, though it has only been since 2002/2003 that a clear distinction between Black Caribbean and Black African groups at the national level has been made in England (Demi, 2003, Dfes 2005 RTP01-05). Present day Caribbean islanders do share a common ancestry with West Africa, therefore common cultural expectations may play a role in explaining this finding, though it was not

examined as to whether or not the Africans in the LSYPE database originated from West Africa.

School profiles are an important factor for accounting for variation in achievement for both English and Caribbean schools. School profiles were examined in Research Question 3 because one Caribbean study suggested that School Rank might alleviate the girl advantage (Kutnick, 1999). Casses and Kingdom (2007) found that while student's social and economic circumstances were the most important factors explaining their educational results, variation in school quality[6] still accounted for 14 percent of variation achievement. Therefore, when examining achievement data, it is crucial that school profiles are accounted for, as they alone may explain a sizeable proportion in variation. English schools are segregated by ability and disadvantage. Students who underperform at Key Stage 2 will more likely advance to schools that have low GCSE attainment and high free school meal rates (DfES, 2005, RTP01-05). Research Question 3 therefore attempted to examine school profiles and in particular isolate ones in which Caribbean boys might perform just as well as Caribbean girls. This attempt however was not successful in identifying mixed gender schools that were more equitable to boys, and perhaps this is due to the fact that these schools might not exist at the secondary level.

Strand (2010) also attempted to pinpoint elementary schools that were more equitable for certain demographic-achievement relationships including the free school meals~achievement relationship, ethnicity~achievement relationship, and the gender~achievement relationship. He found that there was significant variation in the gender gap amongst schools with schools at the 5th percentile having a -.19 SD gender gap whereas schools at the 95th percentile having a -.01 SD gap in favor of boys. (He, however, did not report whether or not the variance of the sex slopes were important in light of the deviance statistics, therefore it is not known the degree of practical importance his significant findings were). He did point out though that very few of these elementary schools eliminated the gender gap between boys and girls. His findings

[6] Indicators of school quality were location, per pupil expenditure, and the rate of low achievement among students eligible for free school meals.

mirrored the findings in Research Question 3 of this dissertation in that no mixed gender school appeared equitable to both genders. Thus, the girl advantage in the progress they make between Key Stage 2 and 3 appears consist in Math and Science, though it may vary for English.

There was no evidence from Research Question 4 that there are major differences in attitudes and behaviors between Caribbean girls and boys. It is possible that the attitudinal/ behavioral constructs defined by the scales were not invariant across the ethnic groups and that although the reliabilities of these scales were at an acceptable level in the population, they might differ for ethnic minority groups. Future studies ought to address the measurement and factorial invariance of the scales across ethnic groups to provide evidence as to whether these scales are appropriate for use or not. Five types of invariance that can be assessed are dimensional (number of factors identified are the same across ethnic groups), configural (same items load onto each factor across ethnic groups), pattern (item's loading is the same across ethnic groups), scalar/strong factorial (intercept/threshold value for each item is the same across ethnic groups), and strict factorial (Meredith & Teresi, 2006)

USA researchers Roopnarine, Krishnakumar, Metindogan, and Evans (2006) cited above also found that authoritarian parenting styles were negatively associated with their kindergarten-aged child's receptive skills whereas authoritative parenting style was positively associated with their kindergarten –aged child's desired social behavior. Further, father parenting was more influential than mother parenting on their child's academic and social skills. Here again, their study gives weight to the argument in the Caribbean regarding the absence of boy role models in the home and its effect on academic performance. This dissertation did not examine the impact of the presences or absence of a male guardian/parent in the home, therefore future studies using the LSYPE database might examine this factor's influence on Caribbean boys' achievement.

Implications for future research and evaluation in the English-speaking Caribbean

The literature review for this study drew upon Caribbean education research and evaluation findings in this region over the past 15 to 20 years. This review demonstrated that psychological factors relating to achievement have generally been being ignored. The examination of such factors using the LSYPE database has been a step towards filling this gap. Future quantitative Caribbean studies ought to include examining psychological factors as they relate to achievement. As it stands, the most common explanation offered to explain this gap is the perception of masculinity and social identity in the English-speaking Caribbean, and now more recently, in England as well. Perceived masculinity and social identity are psycho-social factors, and although qualitative studies suggest these psycho-social factors are avenues that ought to be explored, quantitative studies in this region have yet to examine them. Perhaps one of the reasons why perceived masculinity and gender-identity have not been quantitatively explored in this region is because there is a lack of psychological instruments developed in the English-speaking Caribbean. As a starting point, Caribbean researchers ought to create a psychological instrument that measures perceived masculinity and gender-identity in the Caribbean. Caribbean researchers must also begin creating other psychological tools that are apposite to that region. The fact that the LSYPE database includes students of Caribbean-descent that appear to have similar achievement trends lends itself to Caribbean researchers examining the degree of invariance of the scales in the LSYPE database. If proved appropriate for students of Caribbean descent in the LSYPE database, they may begin adopting and piloting similar items in their region.

In line with the above recommendation, the World Bank launched the 'Early Childhood Initiative: An Investment for Life' two years ago. The initiative was designed to create Early Childhood Development (ECD) programs in select countries world-wide to help reduce inequality among children. Belize, an English-speaking Caribbean country, was one of its targeted areas (though specifically the District of Toledo where mostly indigenous Mayans reside). As part of the initiative, the World Bank commissioned a review of psychometric instruments currently being used for measuring

early childhood development in developing countries (World Bank Report #52105, 2010). The intent of this review was to develop a cross-cultural instrument(s) that can provide a full picture of a child's development for the end goal of contributing to evidence-based policy, decision-making, and early childhood development policies. Psychometricians in the English-speaking Caribbean might attempt to liaison with the World Bank and collaborate on such efforts to ensure construct validity for the English-speaking Caribbean.

A potential group of Caribbean researchers that may liaison with the World Bank is The Child Development Research Group at the University of the West Indies. This group already has pre-established relations with the World Bank and UNESCO, and according to its website, it is "internationally recognized for its work on the cognitive and socio-emotional development of disadvantaged young children. The group conducts high quality research on the effects of early life experiences on development and behaviour which has public health relevance to the Caribbean region and other developing countries" http://www.uwi.edu/tmri/childdevelopmentresearch.aspx. Psychometricians (if any) at the Child Development Research Group, may begin collaborative efforts with the World Bank to facilitate efforts for instrument development in this region.

In a similar fashion, evaluation researchers in the English-speaking Caribbean ought to tailor models of school effectiveness and propose factors that contribute to the School Ranking. If Caribbean governments can identify why some schools are successful and others are not, they perhaps can make more intentional use of school funding and allocate resources to materials and activities (that is, inputs and processes) that make the biggest differences in student achievement. The World Bank has already identified quality indicators for school effectiveness (Meier 2002) but these need to be further examined for the English-speaking Caribbean schools. USA and UK studies have demonstrated that proxies for school quality are often a combination of neighborhood type/zipcode/postal code, proportion of students eligible for free/reduced school meals, and the appropriate allocation of per pupil expenditure (Casses & Kingdon (2007);Greenwald, Hedges, &Laine (1996)). The appropriate allocation of per pupil expenditure is an important facet for Caribbean governments given their limited budgets.

In addition, school quality is often linked with teacher quality. The English-speaking Caribbean has a history of placing better qualified teachers in secondary schools. Since UK studies have found that primary education may have more of an impact on outcomes than secondary education (Duckworth, Akerman, Gutman, & Vorhaus (2009)) similar studies ought to be conducted in the Caribbean given this region's similarity in school organization with the UK. Proxies for teacher quality can be teacher ability, education, and teacher experience (Greenwald, Hedges, & Laine (1996). Most of the English-speaking Caribbean share a common curriculum, have almost identical school organization at the primary and secondary levels, and have educators and administrators that train at select tertiary institutes in this region. All together, these factors set the promise of a prolific future for the application of theory based evaluations (Weiss, 2002), planned variation evaluations (Yeh, 2000) and randomized field trials (Cook and Payne, 2002) that are focused on school effectiveness and isolating the most important factors that contribute to School Rank.

Summary

Overall, the results of this study demonstrate that the Caribbean girl advantage persists beyond the Caribbean and is perhaps innate to the culture. Secondly, no mixed-gender school appeared to be ones in which this gap might be attenuated. This is a cause of concern seeing that Caribbean schools are similar in organization to English schools. Third, Caribbean students might have certain attitudes/behaviors /perceptions that may contribute to why they are performing poorly in English schools, therefore interventions might be implemented to address these factors. Fourth, prior achievement, SES, academic self-concept, and to some extent parent involvement, parent aspirations, and risky behavior, seem to attenuate the girl advantage in Math and Science, but not English. Lastly, the demographic and attitudinal/behavioral factors that account for variation in achievement amongst Caribbean students were still important, even after controlling for school environment. Future evaluation and research in the English-speaking Caribbean

ought to begin identifying factors that account for the school effectiveness and School Ranking so institutional disservice at the school level can be addressed and the proper allocation of resources can take place. Accordingly, boys' underachievement in the English-speaking Caribbean may be due to certain cultural, attitudinal, and discriminatory beliefs that put boys at a disadvantage. Caribbean research then must play a large role in uncovering potential social, economical, and psychological factors that may be the root of this problem. Thus, researchers and psychometricians in this region ought to develop psychological and psycho-social instruments that measure attitudes and behaviors, especially ones related to perceptions of school, education, and masculinity, for more conclusive results regarding attitudes, beliefs, and achievement in the English-speaking Caribbean.

Bibliography

Armstrong, A., Armstrong, D., Lynch, C., & Severin, S. (2005). Special and inclusive education in the Eastern Caribbean: policy practice and provision. *International Journal of Inclusive Education, 9*(1), 71–87. DOI: 10.1080/1360311042000302905

Baker-Henningham, H., Meeks-Garnder, J., Chang, S., & Walker, S. (2009). Experiences of violence and deficits in academic achievement among urban primary school children in Jamaica. *Child Abuse and Neglect, 33*, 296-306.

Bates, D., & Maechler, M. (2010). Package 'lme4'. Reference manual for the package, available at: http://cran.r-project.org/web/packages/lme4/lme4.pdf

Bennet, C (1999). Belize Primary Education Development Project. Improving Quality in the Provision of Education for All in Belize: An Examination of the Impact of a Basic Education Project: Assessment 2000 Monograph Series No. 9, Kingston, Jamaica: UNESCO

Berry, C. (2001). Achievement effects of multigrade and monograde primary schools in the Turks and Caicos Islands. *International Journal of Educational Development, 21*, 537-552.

Blom, A & Hobbs, C. (2008). School and work in the Eastern Caribbean: Does the education system adequately prepare youth for the global economy? Washington, World Bank.

Boissiere, M (2004). Determinants of Primary Education Outcomes in Developing Countries. Background Paper for the Evaluation of the World Bank's Support to Primary Education

Bryan, B. (1996). Learning school: Cross-cultural differences in the teaching of English. *Changing English, 3*(2), 201-207.

Bryan, B. (1997). Investigating language in a Jamaican primary school: perceptions and findings of a group of primary school teachers. *Changing English, 4*(2), 251-258.

Cassen, R. & G. Kingdon (2007) Tackling low educational achievement. York: Joseph Rowntree Foundation.

Charles, L.(1999). Measuring the Impact: An Assessment of Progress in Early Childhood Education: Assessment 2000 Monograph Series No. 5, Kingston, Jamaica: UNESCO

Chin-Quee, D.S. & Scarr, S. (1994). Lack of early child care effects on school-age children's social competence and academic achievement. *Early Development and Parenting, 3*(2), 103-112.

Cook, T., & Payne, M. (2002). Objecting to the objections to using randomized assignment in educational research. In F. Mosteller & R. Boruch (Eds.), *Evidence matters: Randomized trials in educational research.* Washington, DC: Brookings Institution Press.

Darling-Hammond, L. (2000). Teacher Quality and Student Achievement: A Review of State Policy Evidence Education Policies Analysis Archives Volume 8, 1, ISSN 1068-2341.

Demie, F. (2003) Raising the achievement of Black Caribbean pupils in British schools: unacknowledged problems and challenges for policy makers. *London Review of Education, 1*(3), 229-248.

Department for Education and Skills (2005). *Ethnicity and Education: The Evidence on Minority Ethnic Pupils* (Research Topic Paper RTP01-05). Nottingham: DfES [online]. Available at https://consumption.education.gov.uk/

Desforges, C. & Abouchaar, A. (2003). *The impact of parental involvement, parental support and family education on pupil achievement and adjustment: A literature review*. London: Department for Education and Skills.

di Gropello, E. (2003). Monitoring educational performance in the Caribbean. Washington, World Bank.

Dongen, V. (2002). Results of the Escuela Nueva baseline survey for 5 schools in region 1 and 7 schools in region 9. A report written by UNICEF. Retrieved December 30, 2010 from http://origin-ww.unicef.org/french/evaldatabase/files/GUY_2001_801_part_1_report.pdf

Dubrow, E.H., Schaefer, B.A., & Jimerson, R. (2000). Learning behaviors, attention and anxiety in Caribbean children. *School Psychology International, 21*(3), 242-251.

Dubrow, E.H., Schaefer, B.A., & Jimerson, R. (2001). Learning-related behaviors versus cognitive ability in the academic performance of Vincentian children. *British Journal of Educational Psychology, 71*, 471-483.

Duckworth, K., Akerman, R., Gutman, L., Vorhaus, J (2009). Influences and leverages on low levels of attainment: a review of literature and policy initiatives. Research Report 31: Center for Research on the Wider Benefits of Learning.

Durbrow, E.H., Wagstaff, D.A., & Turk N. (2002). Academic standing, peer preference and conduct in Caribbean village children: Are good scholars more popular? *Psychology and Developing Societies*, *14* (2), 312-328.

Dutcher, N. & Tucker, R. (1997). The use of first and second languages in education. A review of international experience. Pacific Islands Discussion Paper Series: No. 1. World Bank.

Eggen, *P*. & Kauchak, D. (1997). Education Psychology: Windows on Classrooms. Seventh Edition. Pearson Merrill Prentice Hall, Upper Saddle River, N.J, Columbus OH.

Evans, H. & Johnson, R. (2001). Identity and academic achievement in single sex and coed schools in Jamaica. *Education and Society, 19*(2), 55-67.

Evans, H. (1999). Gender differences in education in Jamaica. Education for all in the Caribbean: Assessment 2000 Monograph Series No.12. Retrieved on December 10, 2009 from http://unesdoc.unesco.org/images/0013/001364/136430e.pdf.

Figueroa, M. (2000). Making sense of male experience. The case of academic underachievement in the English-speaking Caribbean. *IDS Bulletin, 31*(2), 68-74.

Fitzpatrick, J., Sanders, R., & Worthen, B. (2004). *Program evaluation: alternative approaches and practical guidelines*. (3rd ed.). Boston: Allyn and Bacon.

Fuller, B. (1987). What school factors raise achievement in the third world? *Review of Educational Research, 57*(3), 255-292.

Galler, J.R., Ramsey, F.C., Harrison, R.H., Taylor, J., Cumberbatch, G., & Forde,V. (2004). Postpartum maternal moods and infant size predict performance on a

national high school entrance examination. *Journal of Child Psychology and Psychiatry, 45*(6), 1064-1075.
George, D., & Mallery, P. (2003). SPSS for Windows step by step: A simple guide and reference. 11.0 update (4th ed.). Boston: Allyn & Bacon.
Gift, S. (1999). UNESCO Associated Schools Project Network (ASPnet) and Education for All: Assessment 2000 Monograph Series No. 13, Kingston, Jamaica: UNESCO
Gosai, N. (2009) . Perspectives on the educational experiences of African/Caribbean boys. Ed.D. thesis, University of Birmingham. Available at http://etheses.bham.ac.uk/425/
Greenwald, R, Hedges, L., & Laine, R. (1996). The effect of school resources on student achievement. *Review of Educational Research*, *66*(3), 361-396.
Griffith, A. (1999). Social Studies in Caribbean Schools: Some Challenges for Instruction and Assessment. Assessment 2000 Monograph Series No. 2, Kingston, Jamaica: UNESCO.
Harvey, C. (2000). The EFA Assessment Process in the Caribbean and the Quest for Inclusion and Quality: Implications for Adult and Teacher Education. Assessment 2000 Monograph Series No. 25, Kingston, Jamaica: UNESCO
Hutchinson, S.E., Powell, C.A., Walker, S.*P*., Chang, S.M., & Grantham-McGregor, S.M. (1997). Nutrition, anemia, geohelminth infection and school achievement in rural Jamaican primary school children. *European Journal of Clinical Nutrition, 51*, 729-735.
Iyo, A. (2001). 2001 BZE: School Health and Physical Education Services (SHAPES) program: An impact assessment. A report written for UNICEF. Retrieved December 21, 2010, from http://www.unicef.org/evaldatabase/index_14135.html
Jackson, K. (2009). Peer quality or input quality? Clean evidence from Trinidad and Tobago. Retrieved December, 10, 2009 from www.econ.yale.edu/seminars/labor/lap09/jackson-090911.pdf.
Jennings, Z. (2001). Teacher education in selected countries in the Commonwealth Caribbean: the ideal of policy versus the reality of practice. *Comparative Education Volume 37*(1), 107–134.
Jimerson, S.R., Durbrow, E. H., & Wagstaff, D.A. (2009). Academic and behavior associates of peer status for children in a Caribbean community. *School Psychology International*, *30*(2), 184-200.
Jules, V. & Panneflek, A. (2000). EFA in the Caribbean: Assessment 2000. Sub-regional report, Vol II. State of Education in the Caribbean in the 1990s: Sub-Regional Synthesis and Annexes. Jamaica: UNESCO.
Kelly, R. (2009).Science, Technology and Innovation and Inequality. *Journal of Eastern Caribbean Studies, 34*(3), 78-90
Ketwaru-Nurmohamed, S. (2000). Impact assessment of the Child Minders Initiative. A report written by UNICEF. Retrieved December 21, 2010 from http://www.unicef.org/evaldatabase/files/CAB_2001_034.pdf
Knowlton, L. W., & Phillips, C. C. (2009). *The logic model guidebook: better strategies for great results*. Los Angeles: Sage.

Kutnick, *P*. (1999). Quantitative and case-based insights into issues of gender and school-based achievement: beyond simplistic explanations. *The Curriculum Journal 10* (2), 253-282.

Kutnick, *P*., Jules, V., Layne, A. (1997). Gender and school achievement in the Caribbean –Education Research Paper No. 21, 1997, 126 *p*. Retrieved December 10, 2009 from: http://ageconsearch.umn.edu/bitstream/12859/1/er970021.pdf.

Lam, E. (2011). Sharing best practices in Barbados and Trinidad and Tobago: patterns of policy implementation and resistance. *Compare: A Journal of Comparative and International Education, 41*(1), 25 – 41. DOI: 10.1080/03057925.2010.530746.

Layne, A., Jules, V., Kutnick, *P*., & Layne, C. (2008). Academic achievement, pupil participation and integration of group work skills in secondary school classrooms in Trinidad and Barbados. *International Journal of Education Development, 28*, 176-194.

Leacock, D. (2009). Quality Education for All in the Eastern Caribbean: 1Rethinking the Curriculum in the Face of Universal Secondary Education. *Journal of Eastern Caribbean Studies, 34*(3), 19-38.

Lisle, J.D., Smith, *P*., & Jules, V. (2005). Which males or females are most at risk and on what? An analysis of gender differentials within the primary school system of Trinidad and Tobago. *Educational Studies, 13*(4), 393-418.

Lockheed, M. & Jimenez, E. (1994). Public and private secondary schools in developing countries: what are the differences and why do they persist? Washington DC: World Bank.

Lockheed, M., Harris, A., Gammill, *P*., & Barrow, K. (2006). Impact of now horizons for primary schools on literacy and numeracy in Jamaica 1999-2004. *Journal of Education in International Development, 2*:1. Retrieved December, 10, 2009 from www.equip123.net/JEID/articles/2/New**Horizons**.pdf.

McDonald, B. & Boud, D. (2003). The impact of self-assessment on achievement: the effects of self-assessment training on performance in external examinations. *Assessment in Education, 10*(2), 209-220.

Meredith, W., & Teresi, J. (2006). An essay on measurement and factorial invariance. *Medical Care, 44*(3), S69-S77.

Miller, E. (2000). Education for All in the Caribbean in the 1990s: Retrospect and Prospect. Education for All in the Caribbean: Assessment 2000 Monograph Series No. 19, Kingston, Jamaica: UNESCO.

Parry, O. (1996). In one ear and out the other: Unmasking masculinities in the Caribbean classroom. *Sociological Research Online, 1*(2). Retrieved December 10, 2009 from http://www.socresonline.org.uk/1/2/2.html.

Pinto, R., Ashworth, M., & Jones, R. (2008). Schizophrenia in Black Caribbeans living in the UK. British Journal of General Practice, 58: 429–434.

Plummer, D., Mclean, A., & Simpson, J. (2008). Has learning become taboo and is risk-taking compulsory for Caribbean boys? Researching the relationship between masculinities, education and risk. *Caribbean Review of Gender Studies*. Retrieved December, 10, 2009 from http://sta.uwi.edu/crgs/september2008/journals/DPlummerAMcleanJSimpson.pdf.

Quamina-Aiyejina, L. (2000). Educational quality and the impact of interventions in education in the Caribbean, 1990-1999. An annotated bibliography. Education for all in the Caribbean: Assessment 2000 Monograph Series 21. Retrieved December 10, 2009 from http://unesdoc.unesco.org/images/0013/001363/136398e.pdf.

Raudenbush, S.W. and Bryk, A.S. (2002). Hierarchical Linear Models (Second Edition). Thousand Oaks: Sage Publications.

Regeer, B., Hoes, A., van Amstel-van Saane, M., Caron-Flinterman, F., & Bunders, J. (2009). Six guiding principles for evaluating Mode-2 strategies for sustainable development. *American Journal of Evaluation*,*4*(30), 515-537.

Rodrigues, A. (2000). Effecting a smooth transition from nursery to primary: Final Report. A report written by UNICEF. Retrieved December 21, 2010, from http://www.unicef.org/evaldatabase/index_14309.html

Roopnarine, J.L.; Krishnakumar, A.; Metindogan, A.; Evans, M. (2006). Links between parenting styles, parent-child academic interaction, parent-school interaction, and early academic skills and social behaviors in young children of English-speaking Caribbean immigrants .*Early Childhood Research Quarterly, 21 (2), 238-252i*

Schrouder, S (2008). Educational efficiency in the Caribbean: A comparative analysis. *Development in Practice,,18*(2), 273-279.

Simeon, D., Callender, J., Wong, M., McGregor, S., & Ramdath, D.D. (1994). School performance, nutritional status and trichuriasis in Jamaican schoolchildren. *Acta Paediatr, 83*, 1188-1193.

Simeon, D.T., Grantham-McGregor, S.M., Callender, J., & Wong, M. (1995). Treatment of Trichuris trichiura infections improve growth, spelling scores and school attendance in some children. *The Journal of Nutrition, 125*, 1875-1883.

Smith, D. & Ashiabi, G.S.(2007). Poverty and child outcomes: a focus on Jamaican youth. *Adolescence, 42*(168), 837-858.

Strand, S. (2007). *Minority ethnic pupils in the Longitudinal Study of Young People in England*. DCSF Research Report RR-002. London: Department for Children, Schools and Families. Available online at: http://www.dfes.gov.uk/research/data/uploadfiles/DCSF-RR002.pdf.

Strand, S. (2010). Do some schools narrow the gap? Differential school effectiveness by ethnicity, gender, poverty and prior attainment. *School Effectiveness and School Improvement, 21, (3), 289-314.*

Sylva, K. & Blatchford, I.S. (1995). Bridging the gap between home and school: Improving achievement in primary schools. Retrieved December, 10, 2009 from http://unesdoc.unesco.org/images/0011/001132/113236eo.pdf.

Thompson, B. (2009). Disruptive behaviours in Barbadian classrooms: Implications for Universal Secondary Education in the Caribbean. *Journal of Eastern Caribbean Studies, 34*(3), 39-58.

Walker, S.*P*., Grantham-McGregor, S.M., Himes, J.H., Williams, S., & Duff, E. (1998). School performance in adolescent Jamaican girls: associations with health, social and behavioral characteristics, and risk factors for dropout. *Journal of Adolescence, 21*, 109-122.

Warrican, J. (2009). Quality secondary education for all: An introduction. *Journal of Eastern Caribbean Studies, 34*(2), 1-3.
Williams, D.R., Haile, R., Gonzales, H.M., Neighbors, H., Baser, R. & Jackson, J.S. (2007). The mental health of Black Caribbean immigrants: results from the National Survey of American Life. *American Journal of Public Health, 97,* 52-59.
World Bank (2009a). Implementation completion and results report for St Kitts & Nevis (IBRD-71250). Report No. ICR00001256
World Bank (2009b). Implementation completion and results report for St Lucia (IBRD-71240 IDA-36610). Report No. ICR00001070
World Bank (2010). The promise of early childhood development in Latin America and the Caribbean Report No. 52105- LAC.
World Bank (May, 2000). *Project Appraisal Document, OECS Education Development Program.*Report No. 24159-LAC.
Yeh, S. (2000). Building the knowledge base for improving education and social programs through planned variation evaluations. *American Journal of Evaluation, 21*(1), 27-40.

Appendix I

Explanation of fine grade point scores

TEST AND EXAMINATION POINT SCORES USED IN THE 2007IEVEMENT AND ATTAINMENT TABLES

1. To enable the calculation of average point scores for pupils at various key stages, points are allocated to each of a pupil's test/exam results using the scoring systems set out in this document.

Key Stage 1

KS1 Point Scores for reading task and reading test levels		
National Curriculum Reading Test Level	**National Curriculum Reading Task Level**	**Points Score Equivalent**
Level 4+	-	27
Level 3	-	21
-	Level 2A	17
-	Level 2B	15
-	Level 2C	13
-	Level 1	9
-	W – Working towards Level 1	3
-	X – Not required to take the test	Disregard
-	M – Missing	Disregard
-	D – Disapplied	Disregard
-	A – Absent	Disregard
-	Blank	Disregard

KS1 Point Scores for Writing and Mathematics		
National Curriculum test/task levels	**Point Score Equivalent**	
	Writing	**Mathematics**
Level 4+	27	27
Level 3	21	21
Level 2A	17	17
Level 2B or undifferentiated Level 2	15	15
Level 2C	13	13
Level 1	9	9
X – Not required to take the test	-	-

L – Lower than Level 2	-	-
W – Working towards Level 1	3	3
M – Missing	Disregard	Disregard
D – Disapplied	Disregard	Disregard
A – Absent	Disregard	Disregard

Key Stage 2

KS2 Point Scores for all subjects	
National Curriculum Test Level	**Point Score Equivalent**
5	33
4	27
3	21
2	15
N (Not awarded a test level)	15
B (Working below the level of the tests)	15
Annulled	Disregard
Absent	Disregard
T (Working at the level of the tests but unable to access them)	Disregard
Pupil will take the test in the future	Disregard
Not eligible for the tests (Not at the end of KS2)	Disregard
Lost scripts	Disregard
Missing	0

Key Stage 3

KS3 Point Scores for all subjects			
National Curriculum Test Level	**Point Score Equivalent**		
	English	**Maths**	**Science**
8	-	51	-
7	45	45	45
6	39	39	39
5	33	33	33
4	27	27	27
3	21	21	21
2	-	15	15
N (not awarded a test level)	21	15	15
B (working below the level of the test)	21	15	15
Annulled	Disregard		

Absent	Disregard
T (Working at the level of the tests but unable to access them)	Disregard
Pupil will take the test in the future	Disregard
Not eligible for the tests (Not at the end of KS2)	Disregard
Lost scripts	Disregard
Missing	0

GCSE, A levels and 'equivalences'

National Qualifications Framework

1. The National Qualifications Framework (NQF) sets out the levels at which qualifications can be recognised. Only qualifications that have been accredited by the regulatory authority are included in the NQF. These accredited qualifications are subsequently approved by the Secretary of State for use by pupils of compulsory school age or for 16- 18 year olds. Qualifications approved for use pre-16 and 16-18 include general, vocational and occupational categories.

2. The KS4 Tables report qualifications approved for use pre-16 at level 2, level 1 and Entry level recognised under the NQF. The KS4 Tables also report achievements in AS qualifications taken early. The Post 16 Tables report all approved Level 3 qualifications.

Counting a Wider Range of Qualifications

3. In order to report all approved qualifications in the Tables, the Qualifications and Curriculum Authority (QCA) assigns figures to all qualifications – on a scale equivalent to GCSEs and A-levels. These performance measurement figures are based on the relative challenge and size of a qualification.

4. QCA have assigned each qualification a threshold contribution figure expressed as a percentage as well as a point score:

- 2 A levels (and equivalent) contribute 100% to the level 3 threshold;
- 5 GCSEs at A*-C (and equivalent) contribute 100% to the level 2 threshold; and
-5 GCSEs at A*-G (and equivalent) contribute 100% to the level 1 threshold

5. Using this formula, a GCSE A*-C is equal to one fifth, or 20% of the level 2 threshold. In the same way, all qualifications included in the KS4 Tables have been assigned a percentage contribution to the level 1 and 2 thresholds.

6. Similarly, one A level is equal to half, or 50% of the level 3 threshold. For the purposes of calculating the average level 3 point scores and contextual value added, level 3 qualifications are also assigned a "size" relative to A level.

7. The tables below show, as a guide, a few examples of qualifications at each level, their threshold contribution, size and points allocation. These are used in the KS4 and Post-16 Tables when calculating performance measures.

Example of point scores

8. The following tables list a few of the common qualifications and their point scores based on the new QCA points system. Other approved qualifications at entry level, levels 1, 2 and 3 and their point scores can be found on the QCA website **www.ndaq.org.uk**

Level 1 and 2 performance figures

Qualification	NQF Level	Level 2 threshold contribution	Level 1 threshold contribution	Point score
GCSE - grade A*	Level 2	20%	20%	58
GCSE - grade A	Level 2	20%	20%	52
GCSE - grade B	Level 2	20%	20%	46
GCSE - grade C	Level 2	20%	20%	40
GCSE - grade D	Level 1	0%	20%	34
GCSE - grade E	Level 1	0%	20%	28
GCSE - grade F	Level 1	0%	20%	22
GCSE - grade G	Level 1	0%	20%	16
Intermediate GNVQ - Merit	Level 2	80%	80%	196
Certification in Modern Foreign Languages - Entry level - grade 3	Entry Level	0%	0%	14
NVQ in Performing Engineering Operations - Pass	Level 1	0%	120%	168
National Certificate in Business - Merit	Level 2	80%	80%	196

Qualification	NQF Level	Level 2 threshold contribution	Level 1 threshold contribution	Point score
BTEC First Diploma in Applied Science - Merit	Level 2	80%	80%	196
BTEC First Certificate in Applied Science - Merit	Level 2	40%	40%	98
Key Skills	Level 2	15%	15%	34.5
Key Skills	Level 1	0%	15%	18.8
Basic Skills	Level 2	10%	10%	23
Basic Skills	Level 1	0%	10%	12.5
Asset Language Units – Grade 9	Level 2	5%	5%	13.8
Asset Language Units – Grade 8	Level 2	5%	5%	12.3
Asset Language Units – Grade 7	Level 2	5%	5%	10
Asset Language Units – Grade 6	Level 1	0%	5%	8.5
Asset Language Units – Grade 5	Level 1	0%	5%	7
Asset Language Units – Grade 4	Level 1	0%	5%	4.8

Level 3 performance figures for use in Post-16 Tables

Grade	Size	Points	Grade	Size	Points	Grade	Size	Points

GCE/aGCE/VCE A level			GCE/aGCE/ VCE AS			GCE/aGCE/VCE Double Award		
A	1	270	A	0.5	135	AA	2	540
B	1	240	B	0.5	120	AB	2	510
C	1	210	C	0.5	105	BB	2	480
D	1	180	D	0.5	90	BC	2	450
E	1	150	E	0.5	75	CC	2	420
						CD	2	390
						DD	2	360
						DE	2	330
						EE	2	300

BTEC National Award			BTEC National Certificate			BTEC National Diploma		
D	1	270	DD	2	540	DDD	3	810
M	1	225	DM	2	480	DDM	3	757.5
P	1	165	MM	2	420	DMM	3	705
			MP	2	360	MMM	3	652.5
			PP	2	300	MMP	3	600
						MPP	3	547.5
						PPP	3	495

Advanced Free Standing Maths			Advanced Extension Award			Level 3 Key Skill		
A	0.1667	45	D	0	27	*P*	0.3	63
B	0.1667	40	M	0	23			
C	0.1667	35						
D	0.1667	30						
E	0.1667	25						

International Baccalaureate Diploma Passes (no points are assigned to pupils achieving IB certificates)

Grade	Size	Points	Grade	Size	Points
45	5	1380	34	5	1050
44	5	1350	33	5	1020
43	5	1320	32	5	990
42	5	1290	31	5	960
41	5	1260	30	5	930
40	5	1230	29	5	900
39	5	1200	28	5	870
38	5	1170	27	5	840
37	5	1140	26	5	810
36	5	1110	25	5	780
35	5	1080	24	5	750

Please note that NVQ points and contributions will vary depending on the type of qualification.

Appendix II

Checking the Assumption of Parallel lines

Syntax

FOR PARENT INVOLVEMENT, TEST WITH ORDGEE TO SEE IF PARALLEL LINES TENABLE

$$$$$ These are MARGINAL MODELS THOUGH. They above are random effects models $$$$

```
ord_Inv<-ordgee(ordered(Par_Inv)~year,weights = weights.long,data = data.long, id=id,
corstr="exchangeable")
summary(ord_Inv)
ord_Inv$beta


PI.1<-geeglm(split1_PI ~ year, id=id,data=data.long,weights = weights.long, family=binomial,
corstr="exchangeable")
PI.2<-geeglm(split2_PI ~ year, id=id,data=data.long,weights = weights.long, family=binomial,
corstr="exchangeable")
PI.3<-geeglm(split3_PI ~ year, id=id,data=data.long,weights = weights.long, family=binomial,
corstr="exchangeable")
coef(summary(PI.1))
coef(summary(PI.2))
coef(summary(PI.3))


$$$$$$$$$$$$$$$$$$$$$$$$$  USE ORDGEE  $$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

ord_Inv2<-ordgee(ordered(Par_Inv)~year + factor(Race),weights = weights.long,data =
data.long, id=id, corstr="exchangeable")
summary(ord_Inv2)
ord_Inv2$beta
```

Output

```
************************** GEEGLM logistic splits
****************************************

> coef(summary(PI.1))
             Estimate    Std.err        Wald  Pr(>|W|)
(Intercept) 2.98611257 0.07654093 1522.035779 0.0000000
year        0.03544793 0.03506829    1.021769 0.3120998
> coef(summary(PI.2))
            Estimate    Std.err     Wald Pr(>|W|)
(Intercept) 0.6686887 0.03275538 416.7567        0
year        0.1548941 0.01463181 112.0660        0
> coef(summary(PI.3))
```

```
            Estimate    Std.err      Wald Pr(>|W|)
(Intercept) -1.4924690 0.03531431 1786.1138        0
year         0.1928413 0.01434582  180.6965        0
>
```

********** ORDGEE **********

PARENT INVOLVEMENT
Ordgee using Par_Inv as an ordered factor. If coefficient are similar, then use ordgee

```
> ord_Inv$beta
  Inter:1    Inter:2    Inter:3       year
 2.6670057  0.5940859 -1.4905241  0.1905322
> summary(ord_Inv)

Call:
ordgee(formula = ordered(Par_Inv) ~ year, id = id, data = data.long,
    weights = weights.long, corstr = "exchangeable")

Mean Model:
 Mean Link:                logit
 Variance to Mean Relation: binomial

 Coefficients:
         estimate     san.se       wald           p
Inter:1  2.6670057 0.06952841 1471.37485 0.000000e+00
Inter:2  0.5940859 0.06219281   91.24690 0.000000e+00
Inter:3 -1.4905241 0.06295570  560.54167 0.000000e+00
year     0.1905322 0.03096111   37.87075 7.558999e-10
```

COEFFICIENTS DEMONSTRATE THAT THE PARALLEL LINES ASSUMPTION HOLDS BECAUSE THE ESTIMATES ARE SIMILAR IN MAGNITUDE AND DIRECTION.
USE ORDGEE BECAUSE ITS EASIER

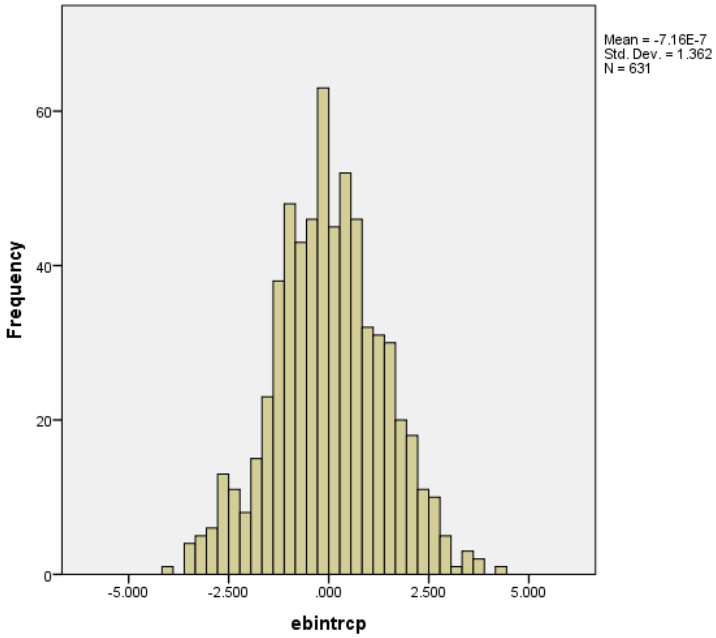
Appendix III

Research Question 3

HLM Model Checking

English achievement

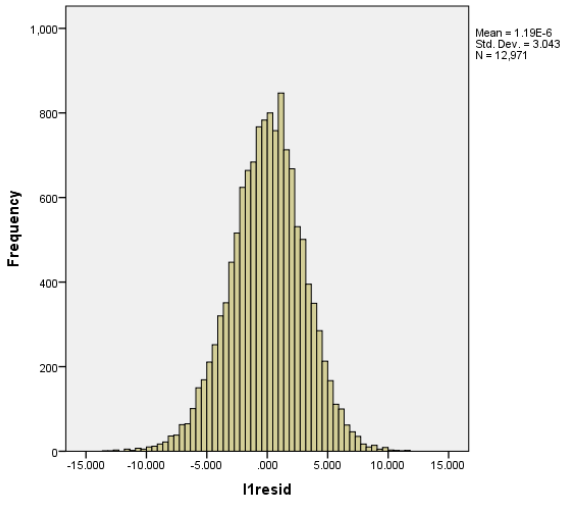
a. Normality of level 2 residuals and mean of zero



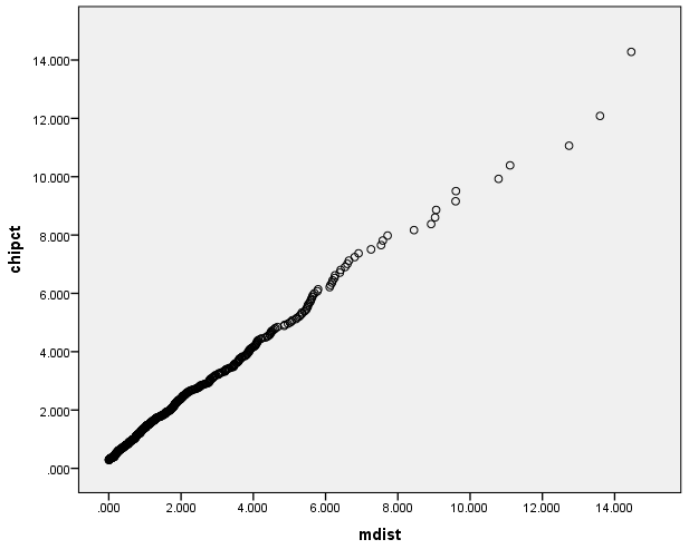
b. Normality of level 1 residuals, mean of zero

c.

d.

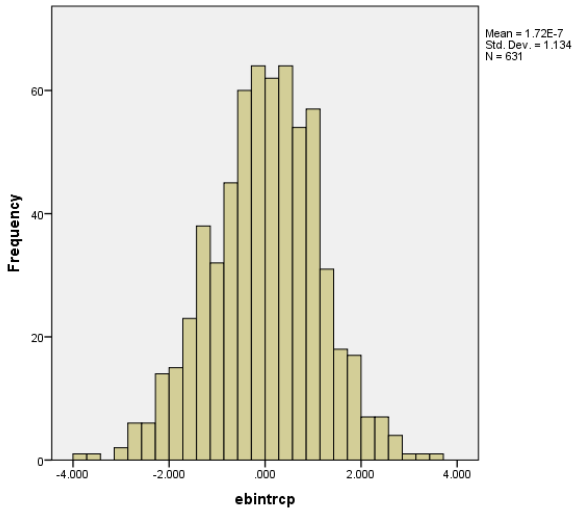


c. Multivariate normal of each cluster. There appears to be a few outliers in the right tail.

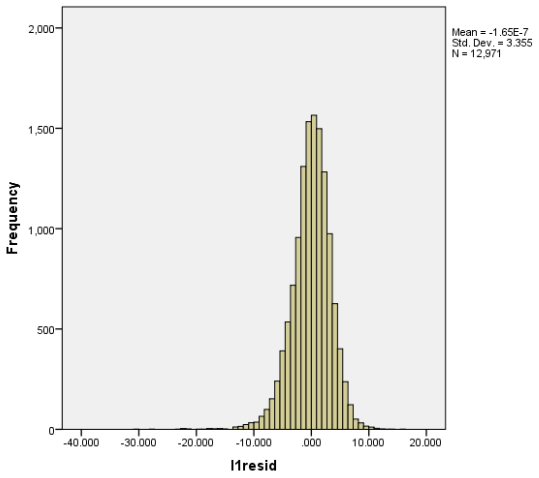


Math Achievement

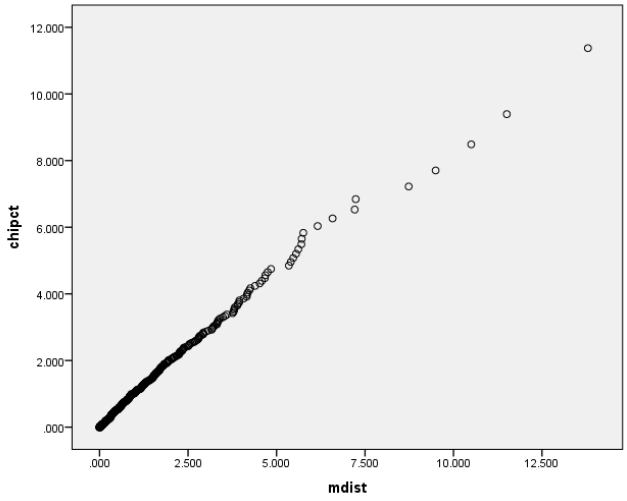
a. Level 2 residual. Normality of residuals



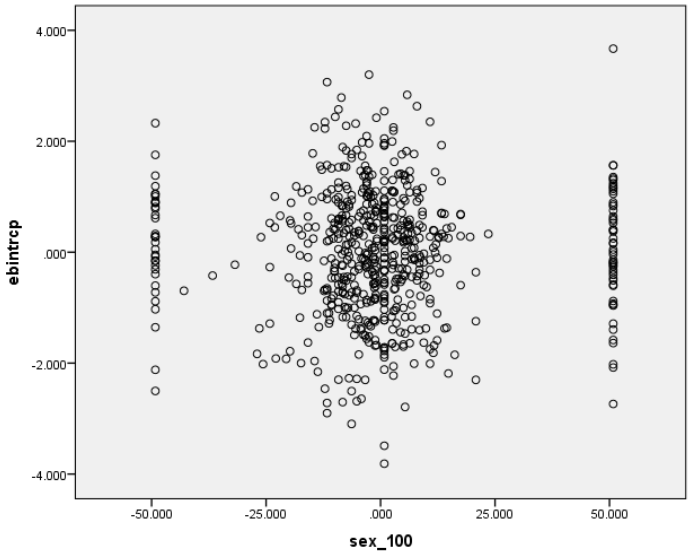
b. Level 1 residuals.



c. Multivariate normality

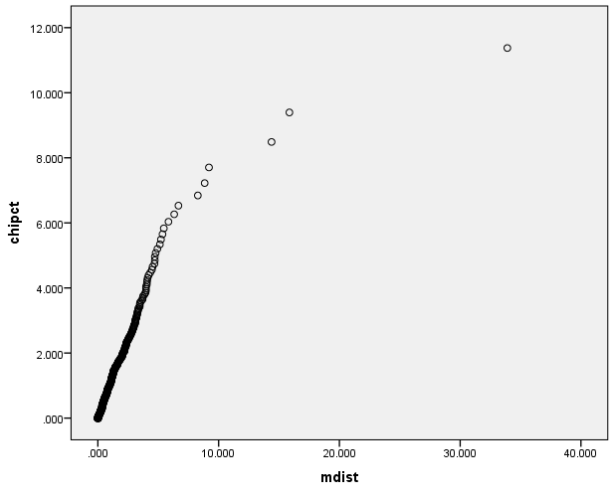


d. Level 2 predictor independence. Testing to see if there is a group effect between the level 2 covariate and the outcome. That is, as the proportion of female changes, does the overall score in math change? Seems fairly independent

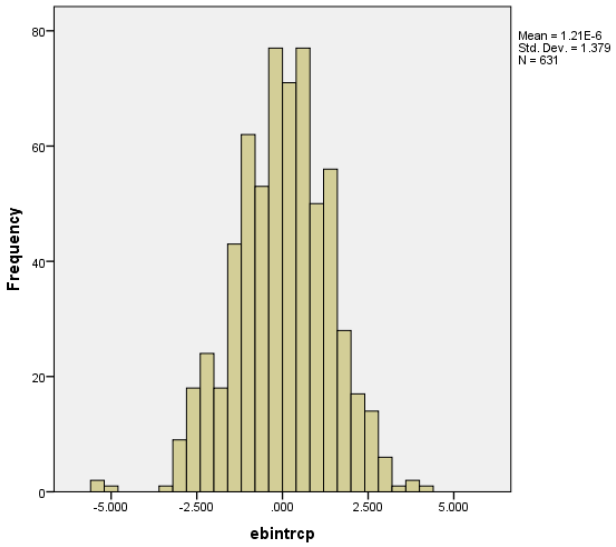


Science Achievement

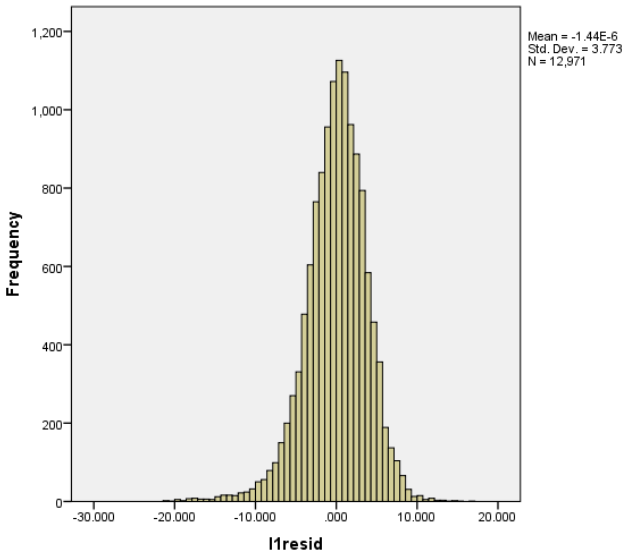
a. Multivariate normality. There seems to be about 6 schools pulling the distribution, otherwise everything else appear to be ok



b. Homogeneity and variance of Level 2 residuals



c. Normality of level 1 residuals. Mean of zero.



Schools in boys group average was higher than boys grand mean average

There were 3 achievement groups resulting from Research Question 3. Group 1 = schools in which boys performed at least one standard deviation above the male mean.

Group 2 = schools in which boys performed at least two standard deviations above the male mean. Group 3 = schools in which boys performed at least three standard deviations above the male mean.

For math achievement, the schools in each of the three groups had parents who were fairly involved with their son's school-life, though generally speaking, about 80% of the boys in each school reported no homework help at home. On average, the schools had about 90% of the parents wanted and expected their sons to go to tertiary education. An inspection of the ranges demonstrate that Group 1 had the most variation in these characteristics, however the greatest variation can be seen in the demographics of free school meals and ethnic make-up of the schools. There was at least one school in Group 1 that had 50% of its boys receiving free school meals, whereas for Group 2, the highest proportion of students within any one school receiving free school meals was only 17%. The greatest contrast lies within Group 3, however there was only one school at this attainment level and none of its boys received free school meals. A similar trend can be seen in the ethnic make-up of the school, with some schools in Group 1 having much more of a diverse population as opposed to Group 2 and 3. Finally, the gender make-up of the school demonstrate that whilst there was at least one school in both Groups 1 and 2 that were all-boys, the school that held the highest boy average in math was an all-boys school. The schools in Groups 1, 2, and 3 for Science achievement displayed very similar patterns to the groups for Math achievement. Finally, for English achievement, the changes in proportion of boys receiving free school meals as well as the ethnic make-up across the groups appeared smaller for English achievement as compared to Math and Science.

Math Achievement

		# of Schools	Mean	SD	SE	Min	Max
Demographic	Group						
Parent School Involvement	1.00	82	2.897	.258	.029	1.95	3.54
	2.00	9	2.950	.259	.086	2.48	3.33
	3.00	1	2.586	.	.	2.59	2.59
	Total	92	2.899	.258	.027	1.95	3.54
Parent Aspirations_mean	1.00	82	.939	.062	.007	.74	1.00
Parent Desire	2.00	9	.974	.034	.011	.92	1.00
	3.00	1	1.000	.	.	1.00	1.00
	Total	92	.943	.061	.006	.74	1.00
Parent Expectation_mean	1.00	82	.907	.083	.009	.65	1.00
Parent Expectation	2.00	9	.947	.049	.016	.85	1.00
	3.00	1	1.000	.	.	1.00	1.00
	Total	92	.912	.081	.008	.65	1.00

Help with HW at home	1.00	82	.825	.103	.011	.50	1.00
	2.00	9	.799	.086	.029	.67	.92
	3.00	1	.800	.	.	.80	.80
	Total	92	.822	.100	.010	.50	1.00
Free School Meals	1.00	81	.081	.116	.013	.00	.50
	2.00	9	.041	.051	.017	.00	.17
	3.00	1	.000	.	.	.00	.00
	Total	91	.076	.111	.012	.00	.50
Carib_mean	1.00	82	.016	.040	.004	.00	.25
	2.00	9	.034	.036	.012	.00	.10
	3.00	1	.000	.	.	.00	.00
	Total	92	.018	.040	.004	.00	.25
Mixed_mean	1.00	82	.054	.059	.006	.00	.25
	2.00	9	.062	.035	.012	.00	.13
	3.00	1	.034	.	.	.03	.03
	Total	92	.055	.056	.006	.00	.25
Indian_mean	1.00	82	.087	.183	.020	.00	.94
	2.00	9	.176	.192	.064	.00	.52
	3.00	1	.276	.	.	.28	.28
	Total	92	.098	.185	.019	.00	.94
Pakistani_mean	1.00	82	.050	.117	.013	.00	.61
	2.00	9	.084	.120	.040	.00	.33
	3.00	1	.034	.	.	.03	.03
	Total	92	.053	.116	.012	.00	.61
Bangladeshi_mean	1.00	82	.021	.052	.006	.00	.32
	2.00	9	.019	.056	.019	.00	.17
	3.00	1	.000	.	.	.00	.00
	Total	92	.020	.052	.005	.00	.32
White_mean	1.00	82	.727	.295	.033	.00	1.00
	2.00	9	.560	.349	.116	.08	.95
	3.00	1	.621	.	.	.62	.62
	Total	92	.709	.301	.031	.00	1.00
BlckAfrican_mean	1.00	82	.027	.068	.007	.00	.35
	2.00	9	.022	.042	.014	.00	.13
	3.00	1	.000	.	.	.00	.00
	Total	92	.026	.065	.007	.00	.35
Proportion of females	1.00	82	143.046	17.480	1.930	100.00	163.64
	2.00	9	125.291	24.439	8.146	100.00	151.72
	3.00	1	100.000	.	.	100.00	100.00

	Total	92	140.841	19.264	2.008	100.00	163.64

English Achievement

		# of schools	Mean	SD	SE	Min	Max
	Group						
Proportion of females	1.00	69	142.1	17.9	2.15	100.00	166.67
	2.00	19	130.7	25.1	5.75	100.00	161.11
	Total	88	139.7	20.1	2.14	100.00	166.67
Free School Meals	1.00	68	.079	.087	.011	.00	.39
	2.00	19	.055	.105	.024	.00	.46
	Total	87	.074	.091	.010	.00	.46
Carib_mean	1.00	69	.035	.075	.009	.00	.44
	2.00	19	.038	.061	.014	.00	.24
	Total	88	.035	.072	.008	.00	.44
Mixed_mean	1.00	69	.059	.059	.007	.00	.23
	2.00	19	.050	.050	.012	.00	.17
	Total	88	.057	.057	.006	.00	.23
Indian_mean	1.00	69	.080	.174	.021	.00	.94
	2.00	19	.135	.202	.046	.00	.68
	Total	88	.092	.181	.019	.00	.94
Pakistani_mean	1.00	69	.026	.056	.007	.00	.23
	2.00	19	.031	.058	.013	.00	.19
	Total	88	.027	.056	.006	.00	.23
Bangladeshi_mean	1.00	69	.014	.040	.005	.00	.25
	2.00	19	.004	.012	.003	.00	.04
	Total	88	.012	.036	.004	.00	.25
White_mean	1.00	69	.741	.274	.033	.03	1.00
	2.00	19	.644	.309	.071	.04	1.00
	Total	88	.720	.283	.030	.03	1.00
BlckAfrican_mean	1.00	69	.027	.069	.008	.00	.45
	2.00	19	.071	.150	.034	.00	.59
	Total	88	.037	.093	.010	.00	.59
Other_mean	1.00	69	.019	.043	.005	.00	.24
	2.00	19	.027	.037	.008	.00	.12
	Total	88	.021	.042	.004	.00	.24
W1schlifMP_mean	1.00	69	2.896	.237	.029	2.39	3.65
	2.00	19	2.969	.236	.054	2.59	3.48

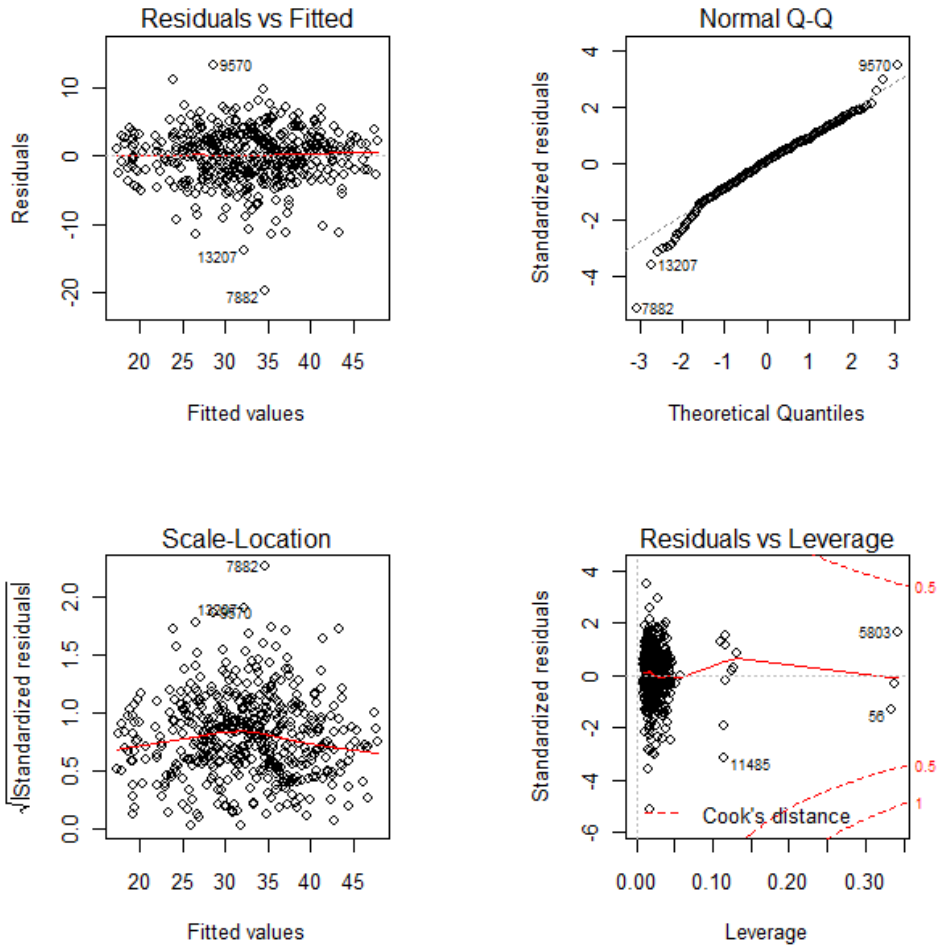
	Total	88	2.912	.237	.025	2.39	3.65
Parent Aspirations_mean	1.00	69	.944	.055	.007	.80	1.00
	2.00	19	.972	.040	.009	.86	1.00
	Total	88	.950	.053	.006	.80	1.00
Parent Expectation_mean	1.00	69	.918	.064	.008	.77	1.00
	2.00	19	.952	.061	.014	.80	1.00
	Total	88	.925	.065	.007	.77	1.00
W1hwhelp_mean	1.00	69	.838	.082	.010	.63	1.00
	2.00	19	.828	.095	.022	.67	1.00
	Total	88	.836	.084	.009	.63	1.00

Science Achievement

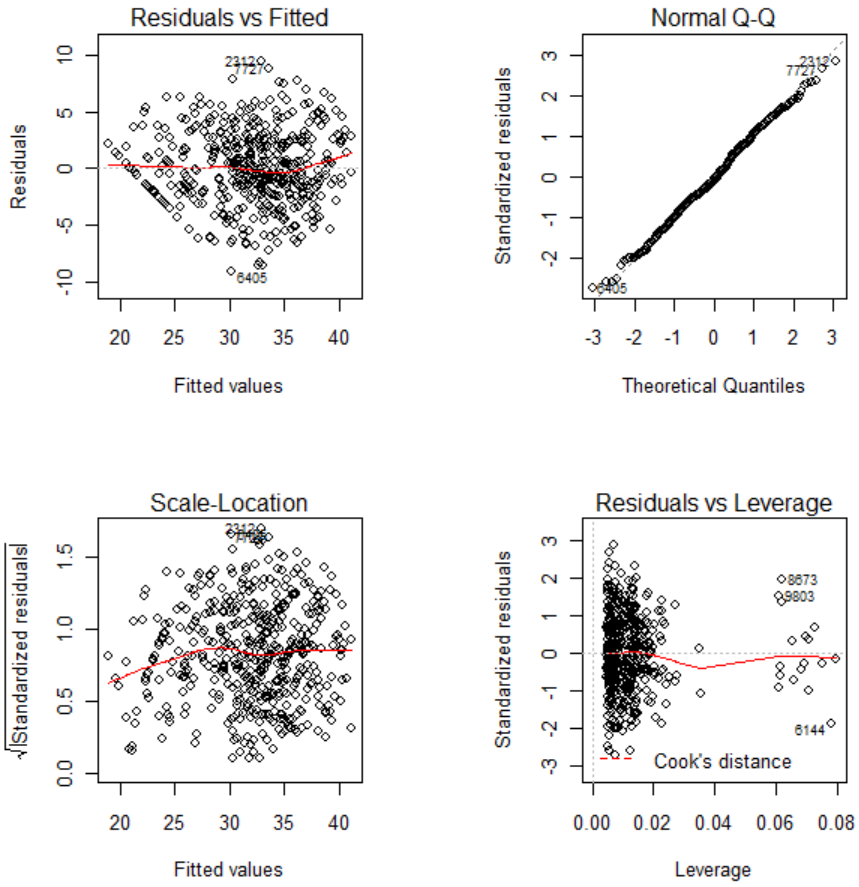
		# of Schools	Mean	Std. Deviation	Std. Error	Minimum	Maximum
Proportion of females	1.00	64	143.4322	14.89402	1.86175	100.00	168.75
	2.00	15	119.8582	25.26424	6.52320	100.00	155.17
	3.00	2	100.0000	.00000	.00000	100.00	100.00
	Total	81	137.9942	20.19430	2.24381	100.00	168.75
Parent Involvement	1.00	64	2.9208	.22657	.02832	2.45	3.65
	2.00	15	2.8575	.22971	.05931	2.48	3.29
	3.00	2	2.9286	.10102	.07143	2.86	3.00
	Total	81	2.9092	.22451	.02495	2.45	3.65
Parent Aspirations	1.00	64	.9404	.04901	.00613	.82	1.00
	2.00	15	.9855	.02914	.00753	.90	1.00
	3.00	2	.9762	.03367	.02381	.95	1.00
	Total	81	.9497	.04880	.00542	.82	1.00
Parent Expectations	1.00	64	.9127	.07059	.00882	.74	1.00
	2.00	15	.9726	.04256	.01099	.86	1.00
	3.00	2	.9583	.00842	.00595	.95	.96
	Total	81	.9249	.06940	.00771	.74	1.00
Help with HW at home	1.00	64	.8402	.09360	.01170	.56	1.00
	2.00	15	.8083	.08944	.02309	.64	.95
	3.00	2	.7306	.07357	.05202	.68	.78
	Total	81	.8316	.09371	.01041	.56	1.00
	Total	81	28.2765	2.81860	.31318	21.54	33.72
Free School Meal	1.00	63	.0678	.08455	.01065	.00	.42
	2.00	15	.0340	.04355	.01124	.00	.15

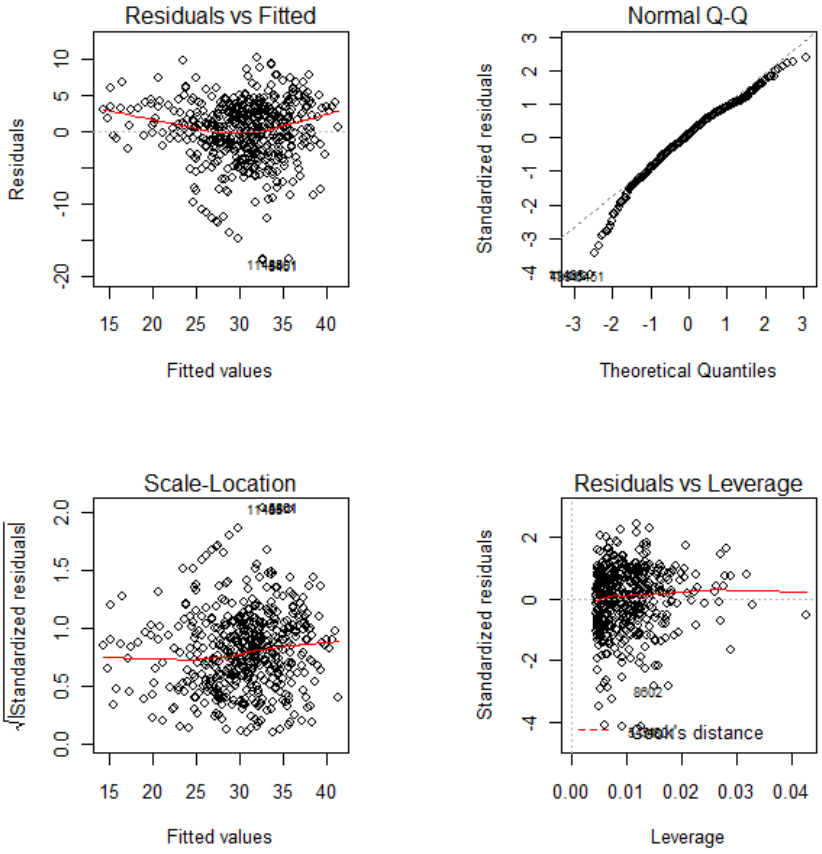
	3.00	2	.0217	.03074	.02174	.00	.04
	Total	80	.0604	.07856	.00878	.00	.42
Carib_mean	1.00	64	.0226	.04702	.00588	.00	.25
	2.00	15	.0349	.07610	.01965	.00	.27
	3.00	2	.0000	.00000	.00000	.00	.00
	Total	81	.0243	.05285	.00587	.00	.27
Mixed_mean	1.00	64	.0586	.06113	.00764	.00	.23
	2.00	15	.0552	.04697	.01213	.00	.15
	3.00	2	.0607	.03710	.02624	.03	.09
	Total	81	.0580	.05786	.00643	.00	.23
Indian_mean	1.00	64	.0743	.16985	.02123	.00	.94
	2.00	15	.0949	.13117	.03387	.00	.37
	3.00	2	.0735	.04241	.02999	.04	.10
	Total	81	.0781	.16068	.01785	.00	.94
Pakistani_mean	1.00	64	.0340	.08856	.01107	.00	.61
	2.00	15	.0364	.05026	.01298	.00	.17
	3.00	2	.0000	.00000	.00000	.00	.00
	Total	81	.0336	.08154	.00906	.00	.61
Bangladeshi_mean	1.00	64	.0194	.05546	.00693	.00	.32
	2.00	15	.0075	.02068	.00534	.00	.07
	3.00	2	.0000	.00000	.00000	.00	.00
	Total	81	.0167	.05025	.00558	.00	.32
White_mean	1.00	64	.7456	.27782	.03473	.03	1.00
	2.00	15	.7231	.26131	.06747	.19	1.00
	3.00	2	.8486	.02968	.02099	.83	.87
	Total	81	.7440	.27037	.03004	.03	1.00
BlckAfrican_mean	1.00	64	.0315	.08482	.01060	.00	.45
	2.00	15	.0249	.05839	.01508	.00	.23
	3.00	2	.0172	.02438	.01724	.00	.03
	Total	81	.0299	.07924	.00880	.00	.45
Other_mean	1.00	64	.0142	.03709	.00464	.00	.24
	2.00	15	.0230	.03581	.00925	.00	.12
	3.00	2	.0000	.00000	.00000	.00	.00
	Total	81	.0155	.03641	.00405	.00	.24

Appendix IV Model Checking
Research Question 4
Caribbean Math

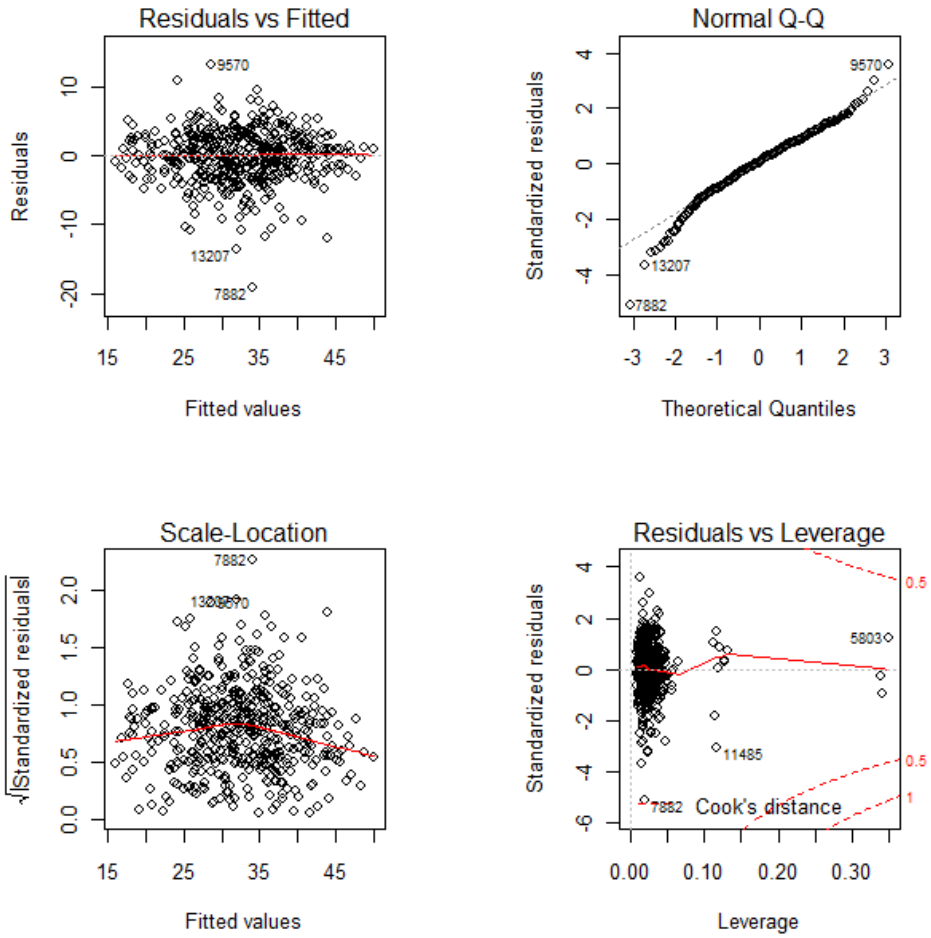


Caribbean English

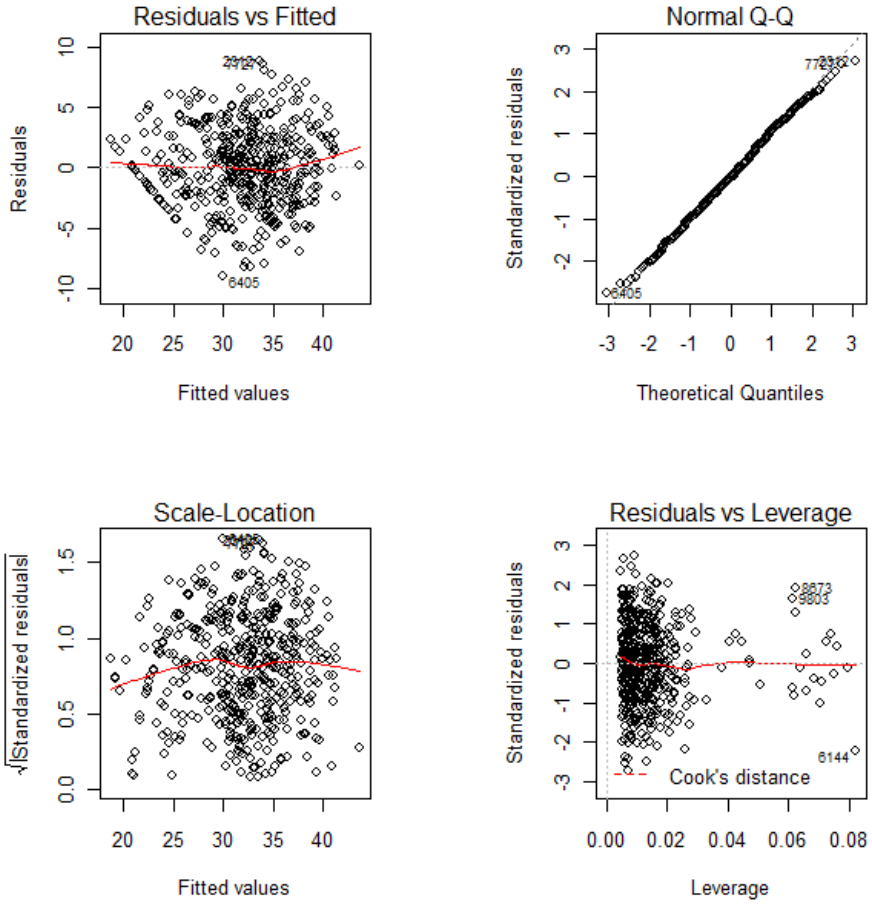



Residuals vs Fitted
Residuals
Fitted values
Normal Q-Q
Standardized residuals
Theoretical Quantiles
Scale-Location
√|Standardized residuals|
Fitted values
Residuals vs Leverage
Standardized residuals
Cook's distance
Leverage

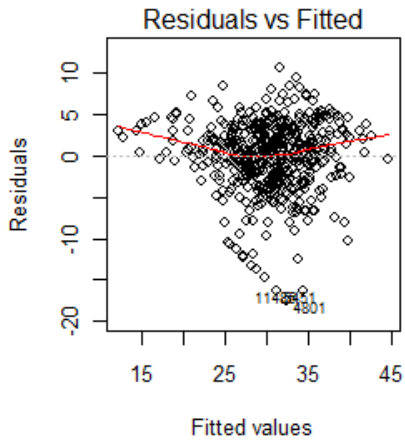
Research Question 5
Caribbean Math School Rank

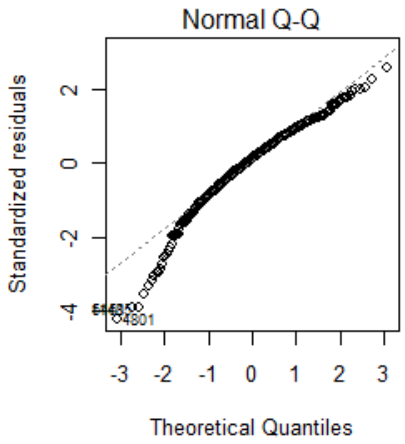


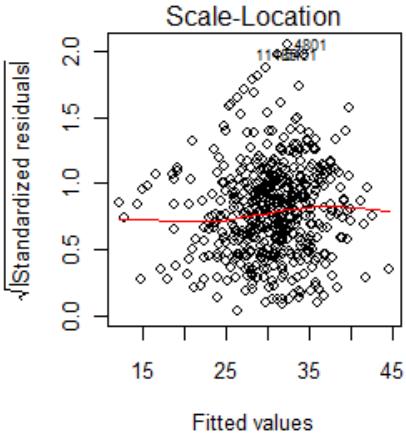
Caribbean English School Rank

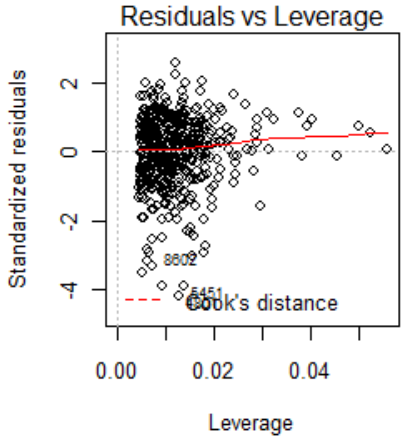


Caribbean Science School Rank


Residuals vs Fitted
Residuals
Fitted values
15
25
35
45
-20
-10
0
5
10
4801


Normal Q-Q
Standardized residuals
Theoretical Quantiles
-3
-2
-1
0
1
2
3
-4
-2
0
2
4801


Scale-Location
√|Standardized residuals|
Fitted values
15
25
35
45
0.0
0.5
1.0
1.5
2.0
4801


Residuals vs Leverage
Standardized residuals
Leverage
0.00
0.02
0.04
-4
-2
0
2
8602
5451
Cook's distance

Appendix V

R Syntax

```
#Read data in#

data.wide<-read.table("C:\\Users\\Anica Bowe\\Desktop\\LSYPE_R_centered
variablesWide.dat", header = TRUE, na.strings = c("-99"))
data.wide<-read.table("C:\\Users\\bowe0152\\Desktop\\LSYPE_R_centered variables.dat",
header = TRUE, na.strings = c("-99"))

head(data.wide)

data.wide$Race.c<-factor(data.wide$Race, labels=c("Caribbean","Mixed","Indian","Pakistani",
            "Bangladeshi", "White", "African", "Other"))

attach(data.wide)
summary(data.wide)
#Reshape data#

data.long <- reshape(data.wide, idvar="id", varying= list(c(6:8),c(9:11),
c(12:14), c(29:31),c(32:34)), v.names = c("Par_Inv", "Par_Want",
"Par_Exp", "Attitude","Risky"),timevar="Year", times = 1:3, direction="long")

data.long<-data.long[order(data.long$id, data.long$Year),]
head(data.long)

############################################################
# Exploring models
# Base model
#Yij = (ß0+b0i) + ß1tij + (ß2Race1i  …ß6Race6i ) + (ß7Race1itij … ß11Race6itij ) + eij

Par_Inv is ordinal.  Parent_Want and Par_Exp were  nominal. Recoded higher ed/school (1) or no
school (0).
heposs = liklihood of higher education. This is ordinal. This can be used for parent expectation
too,
though this is not longitudinal.  It has 4 levels versus the 2 for Par_Exp, so decide which one is
better correlated with outcome.

For the ordinal outcome, to the test of parallel splits using replor or splits.  If it holds, use orgee.
If not, use individual regressions.
For the binary outcome, remember to transform and then interpret the logits back into
probabilities
#############################################################################
###################3
library(foreign)
library(lattice)
library(lme4)
```

```
library(ggplot2)
library(catspec)
library(gtools)
library (geepack)
library(ordinal)

### STEP 1. Describe data and missing data patterns.  Look at the response variables. Is there a pattern to
how the data is missing?  Conduct missing data analysis in SPSS. Read manual on missing data.

## STEP 2. Conduct preliminary analysis by plotting graphs to see shape of data.
Use na.omit because graphing functions may not work with missing data.

## STEP 3. Conduct sensitivity analysis to determine whether we can generalize info to population.
        Not needed. Weights accounted for the missing persons.


############################


STEP 2.  Conduct preliminary longitudinal graphs:- Parent Involvement (ordinal),
      Parent Want (logit), Parent expectations (logit),
      Attitude (linear), Rsky (linear),  *ggplots

      Conduct preliminary cross-sectional graphs:- Locus (linear), Discrimination (linear),
      health (linear)   *(x y plots)


# Preliminary Tables

################
Binary data
################

### Parent_Want BY Year
PW_tab1 <- with(data.long, table(Race,Year))
PW_tab1
ctab(PW_tab1,  type="r", percentages=TRUE)

### Parent_Want BY Year BY Race
PW_tab2 <- with(data.long, table(Par_Want, Race, Year))
PW_tab2
ctab(PW_tab2, type="r", percentages=TRUE)


**********************************************

### Parent_Exp BY Year
```

```
PE_tab1 <- with(data.long, table(Par_Exp,Year))
PE_tab1
ctab(PE_tab1, type="r", percentages=TRUE)

### Parent_Exp BY Year BY Race
PE_tab2 <- with(data.long, table(Par_Exp, Race, Year))
PE_tab2
ctab(PE_tab2, type="r", percentages=TRUE)


**********************************************

################
Ordinal data
################

### Parent_Involvment BY Year
PI_tab1 <- with(data.long, table(Par_Inv,Year))
PI_tab1
ctab(PI_tab1, type="r", percentages=TRUE)        # results show splits 1&2 are similar growth
curves. Consider collapsing

### Parent_Invovlemet BY Year BY Race
PI_tab2 <- with(data.long, table(Par_Inv, Race, Year))
PI_tab2
ctab(PI_tab2, type="r", percentages=TRUE)


#############################################################################
#########

# Create transformed means of the binary and ordinal variables to plot them.

transf<-function(x)log(mean(x)/(1-mean(x)))
ddply(dd, c("dim1","dim2"),
function(df)c(mean(df$v1),mean(df$v2),mean(df$v3),sd(df$v1),sd(df$v2),sd(df$v3)))

transf<-function(x)log(mean(x)/(1-mean(x)))
ddply(dd, c("dim1","dim2"),
function(df)c(mean(df$v1),mean(df$v2),mean(df$v3),sd(df$v1),sd(df$v2),sd(df$v3)))


T
transf
require(plyr)

$$ Create splits for ordinal variable first $$$
data.long$split1_PI<-ifelse(data.long$Par_Inv > 1,yes=1,no=0) # compares first quartile to
everyone else
```

```
data.long$split2_PI<-ifelse(data.long$Par_Inv > 2,yes=1,no=0)  # compares quartiles 1 & 2 to
quartiles 3 & 4
data.long$split3_PI<-ifelse(data.long$Par_Inv > 3,yes=1,no=0)  # compares groups quartiles
1,2,3, to quartile 4

data.long2<-na.omit(data.long)  # logits will not calculate if there's missing data

mysub30_2<-subset (data.long2, id %in% sample ( unique (data.long$id ), size =30))
mysub100_2<-subset (data.long2, id %in% sample ( unique (data.long$id ), size =100))
mysub1000_2<-subset (data.long2, id %in% sample ( unique (data.long$id ), size =1000))

##############################################################################
#########

### PW_Transformed Mean  LOGITS

PW_logits<-ddply(data.long2, c("Year", "Race.c"), function(df)transf(df$Par_Want))
PW_logits
colnames(PW_logits)<-c("Year", "race", "logit")

**********************************************************

### PE_Transformed Mean   LOGITS
PE_logits<-ddply(data.long2, c("Year", "Race.c"), function(df)transf(df$Par_Exp))
head(PE_logits)
colnames(PE_logits)<-c("Year", "race", "logit")

**********************************************************
### PI_Transformed Mean    PROBABILITY.  ANALYZE EACH SPLIT

PInv1_prob<-ddply(data.long2, c("Year", "Race.c"), function(df)mean(df$split1_PI))
head(PInv1_prob)
colnames(PInv1_prob)<-c("Year", "race", "probability")

PInv2_prob<-ddply(data.long2, c("Year", "Race.c"), function(df)mean(df$split2_PI))
head(PInv2_prob)
colnames(PInv2_prob)<-c("Year", "race", "probability")

PInv3_prob<-ddply(data.long2, c("Year", "Race.c"), function(df)mean(df$split3_PI))
head(PInv3_prob)
colnames(PInv3_prob)<-c("Year", "race", "probability")


##############################################################################
#####
GRAPHS OF DISCREET RESPONSES - PLOTS OF THEIR MEAN LOGITS AND
PROBABILITIES
```

```
PWg1<-ggplot(PW_logits, aes(x=Year, y = logit)) + geom_line () + facet_grid(.~race)+
geom_point () + opts (title = " Parent Want (logits)By Year, By Race")
PWg1
************************************************************
PEg1<-ggplot(PE_logits, aes(x=Year, y = logit)) + geom_line () + facet_grid(.~race)+
geom_point () + opts (title = " Parent Expects (logits)By Year, By Race")
PEg1
************************************************************
PInvg1_prob<-ggplot(PInv1_prob, aes(x=Year, y = probability)) + geom_line () +
facet_grid(.~race)+ geom_point () + opts (title = " Parent Involvement(probability)By Year, By
Race")
PInvg1_prob

PInvg2_prob<-ggplot(PInv2_prob, aes(x=Year, y = probability)) + geom_line () +
facet_grid(.~race)+ geom_point () + opts (title = " Parent Involvement(probability)By Year, By
Race")
PInvg2_prob

PInvg3_prob<-ggplot(PInv3_prob, aes(x=Year, y = probability)) + geom_line () +
facet_grid(.~race)+ geom_point () + opts (title = " Parent Involvement(probability)By Year, By
Race")
PInvg3_prob

#OR

attach(data.long2, warn.conflicts = FALSE)   ### NEED TO REMOVE MISSING DATA FOR
THESE GRAPHS TO WORK #####
plot(ddply(data.long2, c("Year"),function(df)mean(df$split1_PI)),lty=1, type="l", ylim=c(0,1),
ylab="Probability", main="Prob by Time_Par_Inv", xaxt="n")
lines(ddply(data.long2, c("Year"),function(df)mean(df$split2_PI)), lty=2)
lines(ddply(data.long2, c("Year"),function(df)mean(df$split3_PI)), lty=3)
axis(side=1, at=c(1:4))
legend("top", legend=c(expression(P(Y[i*j] > 1)),expression(P(Y[i*j] > 2)),expression(P(Y[i*j]
> 3))), lty = c(1:3), bty="n")



library(gtools)
attach(mysub30_2, warn.conflicts = FALSE)
plot(ddply(mysub30_2$split1_PI,.(Year), mean),lty=1, type="l", ylim=c(0,1), ylab="Probability",
main="Prob by Time_Par_Inv", xaxt="n")
lines(ddply(mysub30_2$split2_PI, .(Year), mean), lty=2)
lines(ddply(mysub30_2$split3_PI, .(Year), mean), lty=3)
axis(side=1, at=c(1:4))
legend("top", legend=c(expression(P(Y[i*j] > 1)),expression(P(Y[i*j] > 2)),expression(P(Y[i*j]
> 3))), lty = c(1:3), bty="n")

$$$$$$$$ THESE GRAPHS CAN'T BE SAVED AS OBJECT $$$$$$$$$$$$$
```

```
rm(data.long2)
rm(mysub30_2)
##############################################################################
##########
1. Select random subset from data with missing values included

mysub30<-subset (data.long, id %in% sample ( unique (data.long$id ), size =30))
mysub100<-subset (data.long, id %in% sample ( unique (data.long$id ), size =100))
mysub1000<-subset (data.long, id %in% sample ( unique (data.long$id ), size =1000))

par(mfrow=c(1,1),pty="s")

**************************************************
*INDIVIDUAL CURVES  OF RANDOM SAMPLES
**************************************************
# ATTIUDE INDIVIDUAL CURVES (syntax only for continous data. )

Attg1<-ggplot(data = mysub30, aes(x=Year, y = Attitude, groups = id)) + geom_line () +
        geom_point () + opts (title = "Attitude by Year, Random Thirty Subjects")
Attg1

***********************************

# RISKY INDIVIDUAL CURVES (syntax only for continue data.)

Riskg1<-ggplot(data = mysub30, aes(x=Year, y = Risky, groups = id)) + geom_line () +
        geom_point () + opts (title = "Risky Behavior by Year, Random Thirty Subjects")
Riskg1

**************************************************
*GROUP CURVES OF RANDOM SAMPLES
**************************************************

#  ATTITUDE GROUP CURVE -Random 100 & 1000 Subjects

Attg1.b<-ggplot(data = mysub100, aes(x=Year, y = Attitude)) + geom_line () +
        geom_point () + opts (title = "Plot of Attitude Mean Curve by Years, Random 100
Subjects")+
       stat_summary(fun.y = mean, geom = "line", lwd = 2, linetype = 5)
Attg1.b

Attg1.c<-ggplot(data = mysub1000, aes(x=Year, y = Attitude)) + geom_line () +
        geom_point ()+ opts (title = "Plot of Attitude Mean Curve by Years, Random 1000
Subjects")+
       stat_summary(fun.y = mean, geom = "line", lwd = 2, linetype = 5)
Attg1.c

Attg1.d<-Attg1.c + facet_grid(.~Race.c)
Attg1.d
```

```
Attg1.e<-ggplot(data = data.long, aes(x=Year, y = Attitude))  +
         geom_point ()+ opts (title = "Plot of Attitude Mean Curve by Race")+
        stat_summary(fun.y = mean, geom = "line", lwd = 2, linetype = 5)
Attg1.e

Attg1.f<-Attg1.e + facet_grid(.~Race.c)
Attg1.f

OR

xyplot(Attitude ~ Year, groups=Race.c, data = data.long, type=c("g","p","a"),
main = "Connected Means, The Diffferent Races", auto.key=TRUE)

**************************************************
# RISKY BEHAVIOR GROUP CURVE -Random 100 & 1000 Subjects

Riskg1.b<-ggplot(data = mysub100, aes(x=Year, y = Risky)) + geom_line () +
         geom_point () + opts (title = "Plot of Risky Mean Curve by Years, Random 100
Subjects")+
        stat_summary(fun.y = mean, geom = "line", lwd = 2, linetype = 5)
Riskg1.b

Riskg1.c<-ggplot(data = mysub1000, aes(x=Year, y = Risky)) + geom_line () +
         geom_point ()+ opts (title = "Plot of Risky Behavior Mean Curve by Years, Random 1000
Subjects")+
        stat_summary(fun.y = mean, geom = "line", lwd = 2, linetype = 5)
Riskg1.c

Riskg1.d<-Riskg1.c + facet_grid(.~Race)+ facet_grid(.~Sex)
Riskg1.d

Riskg1.e<-ggplot(data = data.long, aes(x=Year, y = Risky))  +
         geom_point ()+ opts (title = "Plot of Risky Behavior Mean Curve by Race")+
        stat_summary(fun.y = mean, geom = "line", lwd = 2, linetype = 5)
Riskg1.e

Riskg1.f<-Riskg1.e + facet_grid(.~Race.c)
Riskg1.f


# Interaction
Carib<-na.omit(Carib)
Riskg1.e<-ggplot(data = Carib, aes(x=Risky_1, y = Math_2))  +
         geom_point ()+ opts (title = "Plot of Risky Behavior Mean Curve by Race")+
        stat_summary(fun.y = mean, geom = "line", lwd = 2, linetype = 5)
Riskg1.e
```

```
Riskg1.f<-Riskg1.e + facet_grid(.~Sex)
Riskg1.f


**********************************************
CROSS-SECTIONAL MEAN PLOTS
**********************************************

# LOCUS MEANS BY RACE -Random 100 & 1000 Subjects

locusg1<- ggplot(data = mysub1000, aes(x=Race, y =Locus))+ geom_point()+
stat_summary(fun.y = mean, geom = "line", lwd = 2, linetype = 5)
locusg1

selfcong1<- ggplot(data = mysub1000, aes(x=Race, y =Self_Con))+ geom_point()+
stat_summary(fun.y = mean, geom = "line", lwd = 2, linetype = 5)
selfcong1

# DISCRIMINATION MEANS BY RACE
discrimg1<- ggplot(data = mysub1000,aes(x= Race.c, y =Discrimination2)) + geom_point()+
stat_summary(fun.y = mean, geom = "line", lwd = 2, linetype = 5)
discrimg1

# POOR_HEALTH MEANS BY RACE

healthg1<- ggplot(data = mysub1000,aes(y=Poor_Health, x =Race)) + geom_point()+
stat_summary(fun.y = mean, geom = "line", lwd = 2, linetype = 5)
healthg1


**************************************************************************
CENTER VARIABLES FORGOT TO CENTER. USE GRAND MEAN CENTERING
BECAUSE WE  INTERESTED IN FIXED EFFECTS ONLY
**************************************************************************

weights.wide1 <-data.wide$W1_Weight
weights.wide1 <-data.wide$W1_Weight

### Center the variables that weren't already done for the cross sectional analysis

data.wide$W1parasp2MP<-data.wide$W1parasp2MP-0.9223
data.wide$W1parasp1MP<- data.wide$W1parasp1MP-0.8801
data.wide$W1schlifMP<-data.wide$W1schlifMP-2.91
data.wide$W1hwhelp <- data.wide$W1hwhelp-.798
data.wide$SES<-data.wide$fsm_06 #(0 = no free and reduced, 1 = yes free and reduced)
data.wide$SES<- data.wide$SES-0.1791
data.wide$OtherSex = data.wide$Other_Cent*data.wide$Sex_Cent
data.wide$Math_1<-data.wide$Math_1 - 26.3593
data.wide$Eng_1<-data.wide$Eng_1 - 26.3766
```

```
data.wide$Sci_1<-data.wide$Sci_1 - 28.0703
data.wide$School_Rank<-data.wide$School_Rank - 369.9

head(data.wide)

weights.wide = as.numeric(data.wide$W2_Weight)
weights.wide1 = as.numeric(data.wide$W1_Weight)
weights.long = as.numeric(data.long$Weight_Long)


#########################################################
First step, demonstrate need for random intercepts
#########################################################

library(lme4)
library(ordinal)

Att.RI <- lmer(Attitude ~ 1 + (1|id )+ (1|SampPSU), data = data.long, weights = weights.long,
REML = FALSE)
summary(Att.RI)

Risk.RI <- lmer(Risky ~ 1 + (1|id )+ (1|SampPSU), data = data.long, weights = weights.long,
REML = FALSE)
summary(Risk.RI)

ord_Inv<-ordgee(ordered(Par_Inv)~1,weights = weights.long,data = data.long, id=id,
corstr="exchangeable")

Dis_hlm<-lmer(Discrimination2 ~ 1 + (1|SampPSU),weights = weights.wide, data = data.wide,
REML= FALSE)
summary(Dis_hlm)

SC_hlm<-lmer(Self_Con ~ 1 + (1|SampPSU),weights = weights.wide1, data = data.wide, REML
= FALSE)
summary(SC_hlm)

health_hlm<-lmer(Poor_Health ~ 1  + (1|SampPSU),weights = weights.wide, data = data.wide,
REML = FALSE)
summary(health_hlm)

HW<-lmer(W1hwhelp ~ 1 + (1|SampPSU), weights = weights.wide1, data=data.wide, family =
binomial, nAGQ = 1)
summary(HW)

Math<-lmer(formula = Math_2 ~ 1 + (1|SampPSU), weights= weights.wide1,data = data.wide,
REML = FALSE)
Math
```

```
Eng<-lmer(formula = Eng_2 ~ 1  + (1|SampPSU), weights= weights.wide1,data = data.wide,
REML = FALSE)
Eng

Sci<-lmer(formula = Sci_2 ~ 1 + (1|SampPSU), weights= weights.wide1,data = data.wide,
REML = FALSE)
Sci


## Question 1 ##

# Random intercept for Attitude with race and Year as a predictor:
AttRace.RI <- lmer(Attitude ~ 1 + Year  + factor(Race) + (1|id ),weights = weights.long, data =
data.long,REML = FALSE)
summary(AttRace.RI)
AttRaceInt.RI <- lmer(Attitude ~ 1 + Year * factor(Race) + (1|id ), weights = weights.long, data =
data.long,REML = FALSE)
summary(AttRaceInt.RI)
anova(AttRaceInt.RI,AttRace.RI)

# Random intercept for Rsky with Year as a predictor:
RiskyRace.RI <- lmer(Risky ~ 1 + Year + factor(Race) + (1|id ) +(1|SampPSU),weights =
weights.long, data = data.long,REML = FALSE)
summary(RiskyRace.RI)
RiskyRaceInt.RI <- lmer(Risky ~ 1 + Year * factor(Race) + (1|id )+(1|SampPSU),weights =
weights.long, data = data.long,REML = FALSE)
summary(RiskyRaceInt.RI )
anova(RiskyRace.RI,RiskyRaceInt.RI)


WantRaceIn_RI<-lmer(Par_Want ~ 1 + Year * factor(Race) + (1|id) ,weights = weights.long,
data=data.long, family = binomial, nAGQ = 10)
summary(WantRaceIn_RI)
WantRace_RI<-lmer(Par_Want ~ 1 + Year + factor(Race) + (1|id) ,weights = weights.long,
data=data.long, family = binomial, nAGQ = 10)
summary(WantRace_RI)
anova(WantRace_RI, WantRaceIn_RI)

ExpRaceIn_RI<-lmer(Par_Exp ~ 1 + Year * factor(Race) + (1|id) ,weights = weights.long,
data=data.long, family = binomial, nAGQ = 10)
summary(ExpRaceIn_RI)
ExpRace_RI<-lmer(Par_Exp ~ 1 + Year + factor(Race) + (1|id) ,weights = weights.long,
data=data.long, family = binomial,  nAGQ = 10)
summary(ExpRace_RI)
anova(ExpRace_RI, ExpRaceIn_RI)
```

FOR PARENT INVOLVEMENT, TEST WITH ORDGEE TO SEE IF PARALLEL LINES TENABLE

$$$$$ These are MARGINAL MODELS THOUGH. They above are random effects models $$$$

```
ord_Inv<-ordgee(ordered(Par_Inv)~year,weights = weights.long,data = data.long, id=id,
corstr="exchangeable")
summary(ord_Inv)
ord_Inv$beta


PI.1<-geeglm(split1_PI ~ year, id=id,data=data.long,weights = weights.long, family=binomial,
corstr="exchangeable")
PI.2<-geeglm(split2_PI ~ year, id=id,data=data.long,weights = weights.long, family=binomial,
corstr="exchangeable")
PI.3<-geeglm(split3_PI ~ year, id=id,data=data.long,weights = weights.long, family=binomial,
corstr="exchangeable")
coef(summary(PI.1))
coef(summary(PI.2))
coef(summary(PI.3))
```

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$ USE ORDGEE $$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

ORDGEE CANNOT ESTIMATE. USE CLMM

```
Inv_RI<-clmm(ordered(Par_Inv) ~ 1 + year + (1|id) + (1|SampPSU), weights =
weights.long,data=data.long)
summary(Inv_RI)

InvRace_RI<-clmm(ordered(Par_Inv) ~ 1 + year + factor(Race) + (1|id) + (1|SampPSU),weights
= weights.long, data=data.long)
summary(InvRace_RI)

InvInRace_RI<-clmm(ordered(Par_Inv) ~ 1 + year * factor(Race) + (1|id) +
(1|SampPSU),weights = weights.long, data=data.long)
summary(InvInRace_RI)


anova(InvInRace_RI,InvRace_RI)


## Question 2 ####
Is the sex effect consistent across ethnic groups?
Research Question 3. How does the gap compare to other ethnic groups.
T -test using SPSS.
```

JUST SELECT CARIBBEAN STUDENTS OR CREATE SUBGROUPS FOR EACH ETHNICITY AND RUN PARALLEL REGRESSIONS

```
rm(data.wide)
data.wide<-read.table("C:\\Users\\bowe0152\\Desktop\\LSYPE_R_centered variablesWide.dat",
header = TRUE, na.strings = c("-99"))


data.wide$W1parasp2MP<-data.wide$W1parasp2MP-0.9223
data.wide$W1parasp1MP<- data.wide$W1parasp1MP-0.8801
data.wide$W1schlifMP<-data.wide$W1schlifMP-2.91
data.wide$W1hwhelp <- data.wide$W1hwhelp-.798
data.wide$SES<-data.wide$fsm_06 #(0 = no free and reduced, 1 = yes free and reduced)
data.wide$SES<- data.wide$SES-0.1791
data.wide$OtherSex = data.wide$Other_Cent*data.wide$Sex_Cent
data.wide$Math_1<-data.wide$Math_1 - 26.3593
data.wide$Eng_1<-data.wide$Eng_1 - 26.3766
data.wide$Sci_1<-data.wide$Sci_1 - 28.0703
data.wide$School_Rank<-data.wide$School_Rank - 369.9


Carib<- subset(data.wide, Race ==1)
dim(Carib)
Mixed<- subset(data.wide, Race ==2)
Indian<- subset(data.wide, Race ==3)
Pakistan<- subset(data.wide, Race ==4)
Bangladesh<- subset(data.wide, Race ==5)
White<- subset(data.wide, Race ==6)
African<- subset(data.wide, Race ==7)
Other<- subset(data.wide, Race ==8)

### Random intercepts for Design Effect ###

#Carib#
DE_Carib1<-lmer (formula = Math_2 ~ 1  + (1|SampPSU), data = Carib, REML = FALSE)
summary(DE_Carib1)
DE_Carib2<-lmer (formula = Eng_2 ~ 1  + (1|SampPSU), data = Carib, REML = FALSE)
summary(DE_Carib2)
DE_Carib3<-lmer (formula = Sci_2 ~ 1  + (1|SampPSU), data = Carib, REML = FALSE)
summary(DE_Carib3)

DE_Mix1<-lmer (formula = Math_2 ~ 1  + (1|SampPSU), data = Mixed, REML = FALSE)
summary(DE_Mix1)
DE_Mix2<-lmer (formula = Eng_2 ~ 1  + (1|SampPSU), data = Mixed, REML = FALSE)
summary(DE_Mix2)
DE_Mix3<-lmer (formula = Sci_2 ~ 1  + (1|SampPSU), data = Mixed, REML = FALSE)
summary(DE_Mix3)
```

```
DE_Ind1<-lmer(formula = Math_2 ~ 1  + (1|SampPSU), data = Indian, REML = FALSE)
summary(DE_Ind1)
DE_Ind2<-lmer (formula = Eng_2 ~ 1  + (1|SampPSU), data = Indian, REML = FALSE)
summary(DE_Ind2)
DE_Ind3<-lmer (formula = Sci_2 ~ 1  + (1|SampPSU), data = Indian, REML = FALSE)
summary(DE_Ind3)

DE_Pak1<-lmer(formula = Math_2 ~ 1  + (1|SampPSU), data = Pakistan, REML = FALSE)
summary(DE_Pak1)
DE_Pak2<-lmer (formula = Eng_2 ~ 1  + (1|SampPSU), data = Pakistan, REML = FALSE)
summary(DE_Pak2)
DE_Pak3<-lmer (formula = Sci_2 ~ 1  + (1|SampPSU), data = Pakistan, REML = FALSE)
summary(DE_Pak3)

DE_Bang1<-lmer(formula = Math_2 ~ 1  + (1|SampPSU), data = Bangladesh, REML = FALSE)
summary(DE_Bang1)
DE_Bang2<-lmer (formula = Eng_2 ~ 1  + (1|SampPSU), data = Bangladesh, REML = FALSE)
summary(DE_Bang2)
DE_Bang3<-lmer (formula = Sci_2 ~ 1  + (1|SampPSU), data = Bangladesh, REML = FALSE)
summary(DE_Bang3)

DE_White1<-lmer(formula = Math_2 ~ 1  + (1|SampPSU), data = White, REML = FALSE)
summary(DE_White1)
DE_White2<-lmer (formula = Eng_2 ~ 1  + (1|SampPSU), data = White, REML = FALSE)
summary(DE_White2)
DE_White3<-lmer (formula = Sci_2 ~ 1  + (1|SampPSU), data = White, REML = FALSE)
summary(DE_White3)

DE_Afr1<-lmer(formula = Math_2 ~ 1  + (1|SampPSU), data = African, REML = FALSE)
summary(DE_Afr1)
DE_Afr2<-lmer (formula = Eng_2 ~ 1  + (1|SampPSU), data = African, REML = FALSE)
summary(DE_Afr2)
DE_Afr3<-lmer (formula = Sci_2 ~ 1  + (1|SampPSU), data = African, REML = FALSE)
summary(DE_Afr3)

**************************************************************************
## Research Question 2.2 How does the PROGRESS gap compare to other ethnic groups ###


JUST SELECT CARIBBEAN STUDENTS OR CREATE SUBGROUPS FOR EACH
ETHNICITY AND RUN PARALLEL REGRESSIONS


# Carib
Car_math_sex<-lm(formula = Math_2 ~ 1 + Math_1 + Sex_Cent , data = Carib)
summary(Car_math_sex)
Car_eng_sex<-lm(formula = Eng_2 ~ 1 + Eng_1 + Sex_Cent , data = Carib)
summary(Car_eng_sex)
Car_sci_sex<-lm(formula = Sci_2 ~ 1 + Sci_1 + Sex_Cent, data = Carib,)
```

```
summary(Car_sci_sex)

 #Mixed
  Mixed_math_sex<-lm(formula = Math_2 ~ 1 + Math_1 + Sex_Cent, data = Mixed)
  summary(Mixed_math_sex)
  Mixed_eng_sex<-lm(formula = Eng_2 ~ 1 + Eng_1 + Sex_Cent, data = Mixed)
  summary(Mixed_eng_sex)
  Mixed_sci_sex<-lm(formula = Sci_2 ~ 1 + Sci_1 + Sex_Cent, data = Mixed)
  summary(Mixed_sci_sex)

 #Indian
  Indian_math_sex<-lm(formula = Math_2 ~ 1 + Math_1 + Sex_Cent, data = Indian)
  summary(Indian_math_sex)
  Indian_eng_sex<-lm(formula = Eng_2 ~ 1 + Eng_1 + Sex_Cent, data = Indian)
  summary(Indian_eng_sex)
  Indian_sci_sex<-lm(formula = Sci_2 ~ 1 + Sci_1 + Sex_Cent, data = Indian)
  summary(Indian_sci_sex)

 #Pakistan
  Pak_math_sex<-lm(formula = Math_2 ~ 1 + Math_1 + Sex_Cent, data = Pakistan)
  summary(Pak_math_sex)
  Pak_eng_sex<-lm(formula = Eng_2 ~ 1 + Eng_1 + Sex_Cent, data = Pakistan)
  summary(Pak_eng_sex)
  Pak_sci_sex<-lm(formula = Sci_2 ~ 1 + Sci_1 + Sex_Cent, data = Pakistan)
  summary(Pak_sci_sex)

 # Bangladesh
  Bang_math_sex<-lm(formula = Math_2 ~ 1 + Math_1 + Sex_Cent , data = Bangladesh)
  summary(Bang_math_sex)
  Bang_eng_sex<-lm(formula = Eng_2 ~ 1 + Eng_1 + Sex_Cent, data = Bangladesh)
  summary(Bang_eng_sex)
  Bang_sci_sex<-lm(formula = Sci_2 ~ 1 + Sci_1 + Sex_Cent , data = Bangladesh)
  summary(Bang_sci_sex)

 # White
  White_math_sex<-lmer(formula = Math_2 ~ 1 + Math_1 + Sex_Cent + (1|SampPSU), data =
White,REML = FALSE)
  summary(White_math_sex)
  White_eng_sex<-lmer(formula = Eng_2 ~ 1 + Eng_1 + Sex_Cent + (1|SampPSU), data =
White,REML = FALSE)
  summary(White_eng_sex)
  White_sci_sex<-lmer(formula = Sci_2 ~ 1 + Sci_1 + Sex_Cent + (1|SampPSU), data =
White,REML = FALSE)
  summary(White_sci_sex)

 # African
  Af_math_sex<-lm(formula = Math_2 ~ 1 + Math_1 + Sex_Cent , data = African)
  summary(Af_math_sex)
  Af_eng_sex<-lm(formula = Eng_2 ~ 1 + Eng_1 + Sex_Cent, data = African)
```

```
summary(Af_eng_sex)
Af_sci_sex<-lm(formula = Sci_2 ~ 1 + Sci_1 + Sex_Cent , data = African)
summary(Af_sci_sex)
```

##

Research Question 3.

In what type of schools is the affect of sex small? Need HLM to plot B1s against achievement

Does the proportion of females in a school account for variation of slopes? HLM

Carib regressions

##

RESEARCH QUESTION 3. ARE ATTITUDINAL AND BEHAVIORAL FACTORS IMPORTANT FOR EXPLAIN SEX GAP in PROGRESS???

```
Carib<-na.omit(Carib)
dim(Carib)

Carib_m1<-lm(Math_2 ~ 1 + Math_1 + SES + Sex_Cent + Sex_Cent*W1parasp1MP +
Sex_Cent*W1parasp2MP + Sex_Cent*ordered(W1schlifMP) +
        + Sex_Cent*W1hwhelp + Sex_Cent*Self_Con + Sex_Cent*Attitude_1 +
Sex_Cent*Risky_1 +
        Sex_Cent*Discrimination2 + Sex_Cent*Poor_Health, data = Carib)
 summary(Carib_m1)

Carib_m2<-lm(Math_2 ~ 1 + Math_1 + SES + Sex_Cent + Sex_Cent*ordered(W1schlifMP) +
        Self_Con + Sex_Cent*Risky_1, data = Carib)
summary(Carib_m2)

anova(Carib_m1,Carib_m2)


Carib_e1<-lm(Eng_2 ~ 1 + Eng_1 + SES + Sex_Cent + Sex_Cent*W1parasp1MP +
Sex_Cent*W1parasp2MP + Sex_Cent*ordered(W1schlifMP) +
        + Sex_Cent*W1hwhelp + Sex_Cent*Self_Con + Sex_Cent*Attitude_1 +
        Sex_Cent*Risky_1 + Sex_Cent* Discrimination2 + Sex_Cent*Poor_Health, data =
Carib)
summary(Carib_e1)


 Carib_e2<-lm(Eng_2 ~ 1 + Eng_1 + SES + Sex_Cent +  W1parasp2MP + Self_Con , data =
Carib)
 summary(Carib_e2)

anova(Carib_e1,Carib_e2)
```

```
Carib_s1<-lm(Sci_2 ~ 1 + Sci_1 + SES + Sex_Cent + Sex_Cent*W1parasp1MP +
Sex_Cent*W1parasp2MP + Sex_Cent*ordered(W1schlifMP) +
            + Sex_Cent*W1hwhelp + Sex_Cent*Self_Con + Sex_Cent*Attitude_1 +
Sex_Cent*Risky_1 +
            Sex_Cent*Discrimination2 + Sex_Cent*Poor_Health, data = Carib)
 summary(Carib_s1)

Carib_s2<-lm(Sci_2 ~ 1 + Sci_1 + SES + Sex_Cent + Self_Con,  data = Carib)
 summary(Carib_s2)

anova(Carib_s1,Carib_s2)

 ##### WHITE GROUP #######
 White<-na.omit(White)
dim(White)

 White_m1<-lmer(Math_2 ~ 1 + Math_1 + SES + Sex_Cent+ Sex_Cent*W1parasp1MP +
Sex_Cent*W1parasp2MP
         + Sex_Cent*ordered(W1schlifMP) + Sex_Cent*W1hwhelp + Sex_Cent*Self_Con +
Sex_Cent*Attitude_1 +
            Sex_Cent*Risky_1 + Sex_Cent* Discrimination2 + Sex_Cent*Poor_Health
          + (1|SampPSU) , data = White, REML = FALSE)
 summary(White_m1)

 White_m2<-lmer(Math_2 ~ 1 + Math_1 + SES + Sex_Cent+ Sex_Cent*W1parasp1MP +
W1parasp2MP
          + Self_Con +Attitude_1 + Risky_1 + Discrimination2 + Poor_Health
          + (1|SampPSU) , data = White, REML = FALSE)
 summary(White_m2)

anova(White_m1, White_m2)

 White_e1<-lmer(Eng_2 ~ 1 + Eng_1 + SES + Sex_Cent+ Sex_Cent*W1parasp1MP +
Sex_Cent*W1parasp2MP
           + Sex_Cent*ordered(W1schlifMP) + Sex_Cent*W1hwhelp + Sex_Cent*Self_Con +
Sex_Cent*Attitude_1 +
            Sex_Cent*Risky_1 + Sex_Cent* Discrimination2 + Sex_Cent*Poor_Health +
             (1|SampPSU), data = White, REML = FALSE)
 summary(White_e1)


White_e2<-lmer(Eng_2 ~ 1 + Eng_1 + SES + Sex_Cent+ W1parasp1MP + W1parasp2MP
           + ordered(W1schlifMP) + Self_Con + Attitude_1 + Risky_1 + Discrimination2 +
Poor_Health
         + (1|SampPSU), data = White, REML = FALSE)
 summary(White_e2)
```

```
anova(White_e1,White_e2)

 White_s1<-lmer(Sci_2 ~ 1 + Sci_1 + SES + Sex_Cent+ Sex_Cent*W1parasp1MP  +
Sex_Cent*W1parasp2MP +
            Sex_Cent*ordered(W1schlifMP) + Sex_Cent*W1hwhelp + Sex_Cent*Self_Con +
Sex_Cent*Attitude_1 +
             Sex_Cent*Risky_1 + Sex_Cent* Discrimination2 + Sex_Cent*Poor_Health +
(1|SampPSU) , data = White, REML = FALSE)
 summary(White_s1)

 White_s2<-lmer(Sci_2 ~ 1 + Sci_1 + SES + Sex_Cent+ Sex_Cent*W1parasp1MP  +
Sex_Cent*W1parasp2MP +
            ordered(W1schlifMP) + Sex_Cent*Self_Con + Risky_1 + Discrimination2 +
           Poor_Health + (1|SampPSU) , data = White, REML = FALSE)
 summary(White_s2)

anova(White_s1,White_s2)

##############################################################################

Research Question 5.

When controlling for school environment (school rank), are attidunal and belief factor still
important for explaining achievmenet?

Carib_m1Rank<-lm(Math_2 ~ 1 + Math_1 + SES + Sex_Cent + Sex_Cent*ordered(W1schlifMP)
+  Self_Con +  Sex_Cent*Risky_1 + School_Rank, data = Carib)
summary(Carib_m1Rank)

Carib_e1Rank<-lm(Eng_2 ~ 1 + Eng_1 + SES + Sex_Cent + W1parasp2MP + Self_Con +
School_Rank,data = Carib)
summary(Carib_e1Rank)

Carib_s2<-lm(Sci_2 ~ 1 + Sci_1 + SES + Sex_Cent + Self_Con + School_Rank,  data = Carib)
 summary(Carib_s2)


 ##### WHITE GROUP #######

 White_m2Rank<-lmer(Math_2 ~ 1 + Math_1 + SES + Sex_Cent+ Sex_Cent*W1parasp1MP +
W1parasp2MP
          + Self_Con +Attitude_1 + Risky_1 + Discrimination2 + Poor_Health +School_Rank
          + (1|SampPSU) , data = White, REML = FALSE)
 summary(White_m2Rank)

White_e2Rank<-lmer(Eng_2 ~ 1 + Eng_1 + SES + Sex_Cent+ W1parasp1MP + W1parasp2MP
           + ordered(W1schlifMP) + Self_Con + Attitude_1 +
             Risky_1 + Discrimination2 + Poor_Health + School_Rank +(1|SampPSU), data =
White, REML = FALSE)
```

```
 summary(White_e2Rank)

White_e2RankSex<-lmer(Eng_2 ~ 1 + Eng_1 + SES + Sex_Cent+ W1parasp1MP +
W1parasp2MP
           + ordered(W1schlifMP) + Self_Con + Attitude_1 +
             Risky_1 + Discrimination2 + Poor_Health + Sex_mean*School_Rank +(1|SampPSU),
data = White, REML = FALSE)
 summary(White_e2RankSex)

 White_s2Rank<-lmer(Sci_2 ~ 1 + Sci_1 + SES + Sex_Cent+ Sex_Cent*W1parasp1MP  +
Sex_Cent*W1parasp2MP +
            ordered(W1schlifMP) +  Sex_Cent*Self_Con + Attitude_1 +
             Risky_1 + Discrimination2 + Poor_Health + School_Rank+ (1|SampPSU) , data =
White, REML = FALSE)
 summary(White_s2Rank)


#################################################################

GRAPHS FOR INTERACTION EFFECTS
Carib<-na.omit(Carib)
dim(Carib)
head(Carib)
Carib$Sex.c<-factor(Carib$Sex, labels=c("Male","Female"))

g1<-ggplot (data = Carib, aes(x = Risky_1, y = Math_2, groups = Sex.c))
g2<-g1 + stat_smooth ( method = "lm", se = FALSE ) + facet_wrap (~Sex.c)
g2

g3<-ggplot (data = Carib, aes(x = W1schlifMP, y = Math_2, groups = Sex.c))
g4<-g3 + stat_smooth ( method = "lm", se = FALSE ) + facet_wrap (~Sex.c)
g4

Research Question 1

g5<-ggplot (data = data.long, aes (x = Year, y = Risky, groups = Race.c))
g5<-g5 + stat_smooth ( method = "lm", se = FALSE ) + facet_wrap (~Race.c)
g5
```