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CHANGES IN MATH ACHIEVMENT GAPS UNDER THE ERA OF NCLB: BETWEEN DIFFERENT IMMIGRANT STUDENT GROUPS AND NATIVE-BORNWHITEAMERICANS

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ABSTRACT

Previous comparisons of the gaps in educational achievement between various minority groups (non-White, non-English-speaking, low income) and their counterparts (White, English-speaking, middle income) have tended to disregard the immigrant status of the minority students. In this study, I investigated these gaps within and between immigrant student groups in terms of generation status i.e. whether the students were first, second, or third generation immigrants. As the number of immigrant students in U.S. schools continues to increase, it is necessary to pay more attention to such gaps. Furthermore, immigrant students often fall into at least one minority category as a result of race, socioeconomic status, or lack of English proficiency. Their academic attainment should, therefore, be examined in combination with these factors.

The research goal of this study is to examine whether gaps in educational achievement among different groups of immigrant students have changed since the implementation of the NCLB Act. Based on the key premise that the act would raise all students' academic achievement and narrow any achievement gaps, I developed the following hypothesis: if the NCLB Act has been effective, it would by now have helped close the gaps in educational achievement among different generations of immigrant students and different races. To investigate this hypothesis, I posed the following research questions. 1) Are there gaps in the educational achievement of immigrant students from different racial groups compared with their native-born, White counterparts? 2) Are there gaps in educational achievement among different generations of immigrant students within the same racial group? 3) If such gaps exist, were these closed over time from 2003 to 2007?

I used TIMSS 2003 and 2007 data to examine math achievement gaps among students of different immigrant generation groups. In addition, I investigate racial effect of immigrant students on their math achievement. Two-level Hierarchical Linear Modeling was used to analyze the effect nested within schools. The main findings of my study are as follows. Firstly, immigrants are generally likely to underperform compared to their native-born white counterparts. Secondly, achievement gaps among different immigrant generation groups of a same race are likely to be diverse. Thirdly, the pattern of the academic disparities between black or Hispanic immigrants and their native-born white counterparts tend to remain fairly stable over time.

Table of Contents

List of Tables

List of Figures

CHAPTER I

INTRODUCTION

Statement of Problem

In 1983, the National Commission on Excellence in Education asserted in their report that the United States was "a nation at risk" in terms of education. The main premise of the report—that public education in the U.S. was in decline—shocked the nation and generated a national outcry. Public pressure was brought to bear on educators and policy makers to embark on a broad program of educational reform. Public concerns about the drop in educational standards appeared to be confirmed when the U.S. failed to rank near the top in international achievement tests, such as the Programme for International Students' Achievement (PISA) and Trends in International Mathematics and Science Study (TIMSS). The U.S. ranked 28th in the TIMSS in 1997 (13-year-olds) and was placed 12th in the PISA in 2000 (15-year-olds).

The results had a similar impact to that of the Sputnik I shock in 1957 when the former Soviet Union beat the U.S. in the race to launch an artificial satellite into orbit. The fact that U.S. students were not "number one" in math and science threatened the nation's psyche and increased its concern about the country's future. In addition to the lower than expected rankings in the international assessments, other signs point to a drop in the overall quality of U.S. schools. For example, European and Asian countries have vigorously developed and expanded their educational systems over the last 50 years (Peterson, 2003). At the same time, Peterson notes that the U.S. has experienced

stagnation," if not "decline," since the 1970s (Peterson, p.). According to Peterson, the drop-out rates of high-school students, which are higher than ever before, provides solid evidence for a decline in the standard of education in the U.S. Many studies and articles also continue to report signs of a decline in the quality of education in the U.S.

In 2001, in response to the poor academic performance of U.S. students, President Bush's administration and Congress enacted the No Child Left Behind (NCLB) Act, claiming that it would increase accountability in the education system and ensure both excellence and equity in education. The act is intended to ensure that all students, irrespective of their socioeconomic status, attain 100% in the main subject areas. In reality, however, many students who are "in-need" do not meet the proficiency standards required by the act. For example, Title II and VII of the NCLB Act explicitly emphasizes the need to improve these students' English proficiency based on the expectation that this will reduce gaps in their overall academic performance. Despite the policy, students who have limited English proficiency are often left behind (Tung, 2008). Many first- or second-generation immigrant students are classified as having limited English proficiency (LEP); such students are often regarded as being in-need. Consequently, if a school has higher numbers of LEP students, it is more likely to fail to meet AYP (Choi et al., 2007).

In addition, gaps in educational achievement exist not only between English-speaking, White, native-born students and non-English-speaking, colored, immigrant students but also between immigrant groups of the same ethnicity and race (Gao & Tienda, 1995; Zhou, 1997; Portes & Rambaut, 2001), For instance, first- and second-generation Asian students tend to outperform third-generation, native-born counterparts as a result of the influence of their native culture, parental expectations and support, and community support (Zhou, 1997; Portes & Rambaut, 2001).

If the NCLB had been effective, we would expect that the gaps in educational achievement within and between different immigrant groups would have been closed by now. For the past decade, researchers and policy makers have attempted to evaluate the effectiveness of the policy. Some have asserted that the NCLB Act has somewhat contributed to reducing the gaps in educational achievement, whereas other have argued that the act has had little or no effect. According to a report by the NCES, the gaps in educational achievement between White and Black or White and Hispanic students have narrowed (2009). However, others contest this assertion. For example, Lee (2006) found that the gaps among different student racial groups in the U.S. did not change following the implementation of the NCLB Act. Another study pointed out "fundamental errors" in the policy and suggested alternatives to improve its effectiveness (Neill et al., 2005). Although many studies have investigated the gaps in educational achievement among student groups following the enactment of the NCLB Act, comparatively few have examined the effect on immigrant students.

Purpose and Significance of the Study

Previous comparisons of the gaps in educational achievement between various minority groups (non-White, non-English-speaking, low income) and their counterparts (White, English-speaking, middle income) have tended to disregard the immigrant status of the minority students. In this study, I investigated these gaps within and between immigrant student groups in terms of generation status i.e. whether the students were first, second, or third generation immigrants. As the number of immigrant students in U.S. schools continues to increase, it is necessary to pay more attention to such gaps. Furthermore, immigrant students often fall into at least one minority category as a result

of race, socioeconomic status, or lack of English proficiency. Their academic attainment should, therefore, be examined in combination with these factors.

To determine the potential role of immigrant status on educational outcomes, I examined gaps in educational achievement between 1) immigrant students from different racial groups and their native-born, White counterparts and 2) among different generations of immigrants within the same racial group.

Research Questions

The research goal of this study is to examine whether gaps in educational achievement among different groups of immigrant students have changed since the implementation of the NCLB Act. Based on the key premise that the act would raise all students' academic achievement and narrow any achievement gaps, I developed the following hypothesis: if the NCLB Act has been effective, it would by now have helped close the gaps in educational achievement among different generations of immigrant students and different races. To investigate this hypothesis, I posed the following research questions.

1) Are there gaps in the educational achievement of immigrant students from different racial groups compared with their native-born, White counterparts?

2) Are there gaps in educational achievement among different generations of immigrant students within the same racial group?

3) If such gaps exist, were these closed over time from 2003 to 2007?

These questions will be addressed using the Trend in Mathematics and Science (TIMSS) data of 2003 and 2007. I will use stepwise Ordinary Least Square (OLS) regressions and Hierarchical Linear Modeling (HLM) to analyze these data. The next chapter reviews the literature and empirical evidence regarding immigrant students, highlighting the association between student immigrant status and school learning.

CHAPTER II

LITERATURE REVIEW

Theoretical Frameworks

Enrollment of immigrant students in American K-12 schools has rapidly increased in the last four decades. However, many of them are still categorized as students "in-need" at school. Recent immigrants are generally from Latin American and Asian countries. Thus, they tend to be non-white, non-English speakers, not highly educated, and poor. Due to their disadvantageous conditions, they tend to be vulnerably affected by government policies (Dinan, 2005). Hence, it is necessary to examine the complex process of immigrant students' learning and consequent achievements with consideration to government policy.

Traditional learning theories tell us that both innate and acquired factors influence students' academic achievements. These factors can be classified into three categories: early development, school environment and the home circumstances (Barton & Coley, 2009). The early development category explains the inherent parts of their learning experience such as gender and race. On the contrary, the home and school contexts account for what students are influenced by as they grow up. For instance, the home circumstances category includes their parents' income, parents' education level, and the number of their siblings, whereas the school context means school-level factors such as school size, public/private school, location of school, and parental involvement in school activities. Aside from these three factors, one should take the influence of education

policies into consideration since they are strongly linked to expenditure on education which either directly or indirectly affects students' learning and their academic outcomes. Likewise, these factors blended together can explain the causes of academic gaps among students.

The process of immigrant students' learning is relatively more complex than that of their native-born counterparts since socio-cultural factors also play important roles such as racial/cultural identity and social support/pressure from their peer groups, family, and even the community where the immigrant students belong (Mitsutomi & McDonald, 2005). Hence, it is necessary to clarify what factors should be considered when studying the achievement gaps of immigrant students. Figure 1 shows the conceptual model for the six categories of factors that can affect academic achievement of immigrant students. This figure helps to determine which variables, representing these factors, should be included in the analysis.

In this chapter, the five main factors mentioned above will be thoroughly examined. This will be accompanied through an in-depth discussion of policy (NCLB) influence that has recently changed overall immigrant students' academic activities and consequent achievement. In the first section, I will summarize American immigrant history, concentrating on the 1960s and beyond. Then I will discuss how socio-cultural factors, represented by race/ethnicity, are related to immigrant students' assimilation and academic achievement. Assimilation, by definition, is a form of socialization "by which the characteristics of members of immigrant groups and host societies come to resemble one another" (Brown & Bean, 2006). Moreover, assimilation processes may continue over time and generations until there is little or even no distinction between them and the "general population" (Hirschman, 2001). Because assimilation patterns tend to be different depending on generation status, it is necessary to look at how generation status

is related to immigrant children's academic achievement as well as their assimilation into American society. Because language is always one of the primary issues regarding immigrant education, I will also examine how English proficiency affects immigrant student achievement. In the last section of this chapter, I look will into what NCLB stipulates about immigrant education, focused on underlying ideas and expectations. In addition, I reviewed previous research about the impact of NCLB on immigrant students' academic achievement.

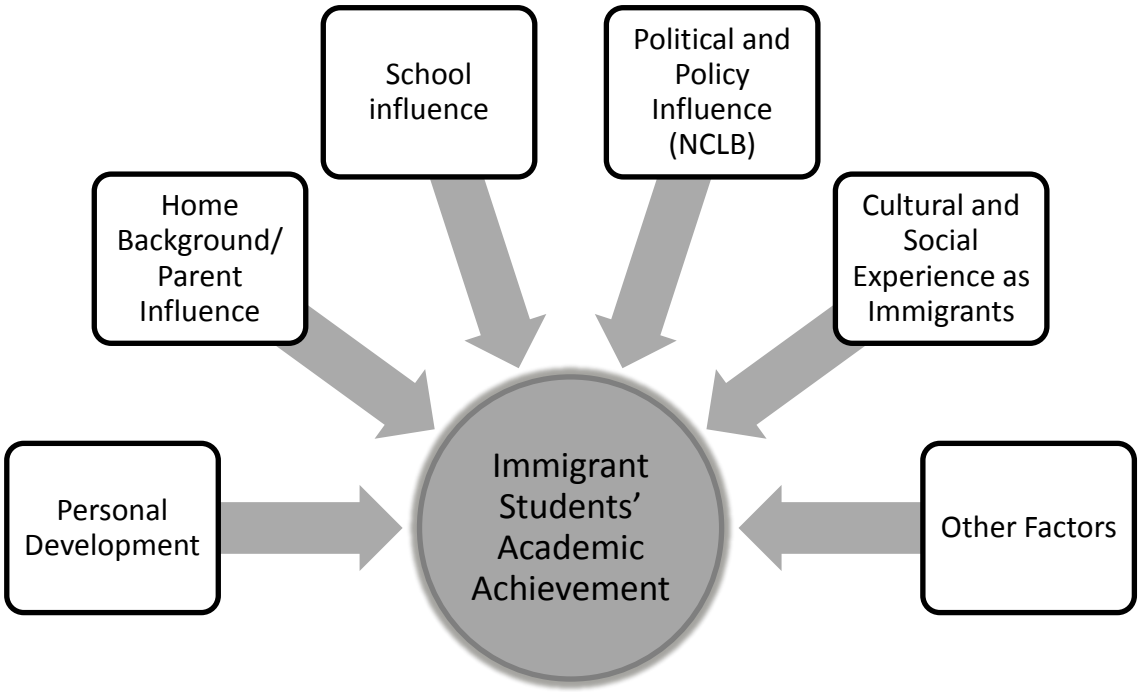

*Figure 2.**Error! No text of specified style in document.** 1* Conceptual Model for Influential Factors on Immigrant Students' Academic Achievement

Brief History of US Immigration

By virtue of the recent development in the fields of transportation and information technology, migration between countries has become extensive worldwide (Rong & Preissle, 2009). For example, people from developing countries immigrate to more industrialized and developed countries seeking jobs or better education opportunities. Conversely, people from more developed countries move to developing countries in search of affordable living and foreign experience. However, no country in the world has experienced such rapid and voluminous increase of immigrants over a short period as United States has recently (Rong & Preisssle, 2009). With its unique immigration history, the United States has been acknowledged as a "melting pot" or "salad bowl" country of diverse races and cultures. The US Census reported that 11.5% of the total population in 2005, approximately 31 million people, was foreign-born, and the number is still increasing (Farenga & Ness, 2005; Papademetriou & Terrazas, 2009; Rong & Preisssle, 2009).

The immigration pattern of the United States has changed in response to contemporary trends. Immigrants have entered the United States in different economic, political, and social atmospheres and under the influence of different governmental policies (Rong & Preissle, 2009). With respect to its characteristics, U.S. immigrant history has exhibited four major waves. The first wave of immigration began with the early British settlers and lasted until the 1820s. Then, non-English-speaking immigrants from Western European countries such as Germany and Ireland entered the country from around the 1850s until the 1920s. The third wave was between 1917 and 1924, during which a series of laws were enacted to set annual quotas intended to regulate the inflow of non-white, non-European immigrants into the United States (Rong & Preissle).

The fourth wave began in 1952 with the implementation of the McCarran-Walter Act, which continued the quota system based on country of origin and excluded people who came from communist countries (Briggs, 1992). However, President Johnson signed the Immigration and Nationality Act of 1965 to eliminate any discrimination based on race, birth location, and gender within the law (Briggs, 1992; Rong & Preissle, 2009). Consequently, the scale of inflow from non-European countries increased. For instance, an annual limitation of 170,000 people was established for immigrants from Asian countries with no more than 20,000 permitted per country, while the annual limitation from the European countries was set at 120,000 people (Rong & Preissle, 2009).

Expansion of non-European immigrants was further accelerated by the Immigration Reform and Control Act (IRCA) of 1986 (Cooper & O'Neil, 2005; Rong & Preissle, 2009). Because it sanctioned illegal status of aliens who had resided in the United States for longer than a given duration, an estimated over 2.7 million immigrants (many of whom were non-European) obtained legal status at that time (Rong & Preissle, 2009). In a similar vein, the Immigration Act was established in 1990. This law also raised the limit of annual inflow of immigrants from 500,000 to 700,000 people.

Thanks to the Immigration Act of 1990, the United States has recently experienced a more remarkable growth of immigrants than has been seen at any other time in its history. Even the demographics of the country have changed rapidly because of this immigration rush (Rong & Preissle, 2009). As a consequence, new social concerns have emerged related to children of immigrants. The academic disparity between immigrant students and their native-born counterparts—as well as between competing immigrant students themselves—is considered a growing social issue during the era of accountability.

U.S. Immigrants Today

Recent newcomers to American soil are diverse in respect to their ethnicities or origins and enormous in number. Just like the immigrants from European countries before the 1960s, many of the recent immigrants also settle down in large metropolitan areas such as New York, Chicago, Los Angeles, Houston, and Miami. For instance, there are currently about 10 million immigrants who are foreign-born or children of foreign-born parents residing solely in California, and this is about one fifth of the state's population. Although the vast majority of recent immigrants have chosen to reside in urban areas, they are spreading out even toward rural areas for the last two decades (Jensen, 2006).

Among all ethnic/race groups, the Hispanic population has increased the most compared with 10 years ago (U.S. Census, 2009). Figure 2 displays the population composition of the United States. Hispanics already outnumbered the Black population in 2006 and became the second-largest population group. Frey (1999) expects that more than half of the U. S. population will be comprised of the descendants of Hispanic and Asian immigrants by 2030.

Along with the swell in population, social issues related to immigrants have emerged. Immigrants came to the United States for various reasons such escape from political persecution, pursuit of freedom, better job opportunities to stop the poverty, and to provide better lives for themselves and their children. Although some of second- and third-plus generations have succeeded in upward mobility, many of first-generation and second-generation immigrants still live in poverty and belong to the lower class of the American society. In addition, the newcomers often lack English proficiency and higher education, which are the requirements for better-paying jobs. Children of these recent

immigrants are no exception to this situation. Many of Hispanic and some of Asian immigrant children live where impoverishment and crimes prevail throughout the community and attend poorly-funded, urban, public schools. Immigrant students enrolled in such schools often fail to meet the Annual Yearly Progress (AYP) standard and are literally left behind, or even drop out of school (Ruiz-de-Velasco & Fix, 2000; Suarez-Orozco, 2001; Rong & Preissle, 2009).

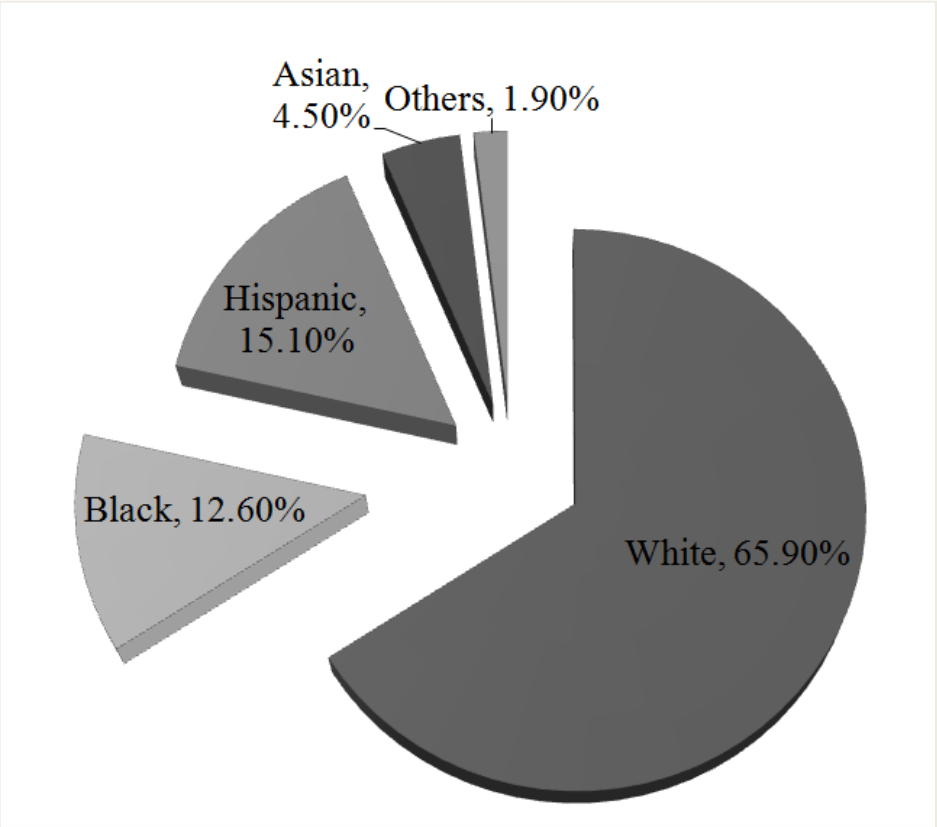

Figure 2.2 U.S. Population Composition by Race/Ethnicity

Source: U.S. Census Bureau (2009)

Immigrant Assimilation and Academic Achievement

Not all immigrants experience the adjustment process in the same way. Their experiences in the United States can differ according to social and political contexts as well as racial and cultural backgrounds. The more similarities that immigrants share with white, native-born, and middle-class Americans, the easier and sooner they will assimilate into the mainstream. However, immigrants, especially first- and second-generation, tend to be colored, not wealthy, less educated, and possess a lack of fluency in English. Hence, it is no wonder that immigrant students are generally classified into at least one minority group and become the objective of government policy in the era of accountability. In this section, I will display related literature about immigrant students' academic achievements as part of the assimilation process.

Historically, education is considered a means of potential social mobility (Noworol, 2006; Zimmerman, 2008; Machin et al, 2008). Therefore, academic outcomes of immigrant children can be regarded as a reliable barometer to predict assimilation into the mainstream of the host country. In addition, schools are "the primary entry point into host societies" and the first formal setting where immigrant children are exposed to their new culture (Jouët-Pastré et al., 2005). Accordingly, American citizens anticipate education will contribute favorably to the successful acculturation of immigrant children. As they are educated at schools, immigrant children acquire not only the English language, but also social norms and American culture, which prevent them from being marginalized in society.

However, not all immigrant children succeed in education. Different assimilation experience may result in different academic outcomes of immigrant children (Portes & Zhou, 1993; Portes & Rumbaut, 2001). According to Portes and Zhou (1993), various

factors such as race/ethnicity, residential location, generation status, social atmosphere, and government policies can affect the academic outcomes of immigrant children. For example, Mexican immigrants in California or Texas and Cuban immigrants in Florida showed different assimilation patterns and accordingly different academic outcomes, although they have similar racial/ethnic backgrounds (Portes & Zhou, 1993; Kao & Tienda, 1995). In addition, even within the same ethnic immigrant group, immigrant children's academic experiences differ depending upon their generations. For instance, first-generation Punjabi immigrants in California area tend to outperform their second- or third-generation/native-born counterparts. Likewise, there are many factors which can affect immigrant students' academic achievements (Gibson, 1988; Zhou, 1997).

Many studies about immigrants and education have shown that the generation status of immigrant children and their race/ethnicity are strong and influential factors (Portes & Rumbaut, 2001; Schwartz & Stiefel, 2006; Rong & Preissle, 2009). Researchers briefly defined three different assimilation patterns depending upon generation status and race/ethnicity. First-generations are those who themselves and also their parents are foreign-born, second-generations are native-born children with at least one foreign-born parent, and third-generations or native-borns are children who were born in the US and have native-born parents (Gibson, 1988; Portes & Zhou, 1993; Schwartz & Stiefel, 2006).

In the following sections, I will discuss three major perspectives regarding immigrant assimilation. Each of these theories explains different assimilation patterns of different immigrant groups. Referring to these perspectives, I will discuss how immigrant generation status and race/ethnicity can affect immigrant children's academic achievements. The three assimilation theories are: 1) The classic (or straight-line) assimilation theory, 2) The oppositional (or downward) assimilation theory, and 3) The segmented assimilation theory.

Classic Assimilation (Straight-line) Theory

Classic assimilation theory supposes that immigrants and their children follow a "straight-line assimilation" for social mobility (Brown & Bean, 2006). The term "straight-line assimilation" was first used by Warner and Srole in 1945 (cited in de Palo et al., 2006). The main idea of this theory is that as immigrants live longer in a host country and become familiar with its language, culture, social values, and norms, their attitude also becomes similar to that of the mainstream people in the host country. In other words, this theory assumes that the more the immigrants learn and imitate "the American way of life," the better they can assimilate themselves to the mainstream American society.

This theory also explains the assimilation of early immigrants from European countries (Brown & Bean, 2006). In the 19th and early 20th centuries, most immigrants came from European countries such as Ireland and Italy. Upon arrival, since their appearance and language were somewhat, yet distinctively, different from those of native-born Anglo-Saxon Americans, they were regarded as "racially inferior (Brown & Bean, 2006)." However, as generations shifted, they naturally acquired American English and adapted the American culture. In addition, since they were not colored (in other words, non-black or non-yellow), they were eventually regarded as one of the members of the white mainstream American society (Brown & Bean, 2006). Therefore, they could join into the mainstream white society relatively easier than later immigrants from other regions of the world.

In regard to education, straight-line assimilation expects that first-generation immigrant students will underperform in comparison to their second-generation or native-born counterparts. In the same line, the straight-line assimilation theory expects

immigrant children will do better as their generation shifts. This perspective can explain the assimilation pattern of the early European settlers who succeeded in blending into the mainstream American society as two or three generations pass.

Except for the early European immigrants, this theory still seems to be valid when applied to certain groups of current immigrants. For example, the life of second- and third-plus generations is far closer to complete assimilation and upward mobility than their first-generation counterparts because the second-plus generation immigrants tend to attain higher academic degrees and enroll in various professional occupations in American society. According to Haskin and his colleagues in the Economic Mobility Project report (2008), while the percentage of first-generation immigrants who have more than some college degree is 27% that of second-generation immigrants is 31%. Moreover, the overall educational attainment of second-generation exceeds that of first-generation immigrants.

However, despite its original idea regarding the process of immigrant assimilation, straight-line assimilation has been criticized these days (Yancey, 2003). The opponents argue that the straight-ling assimilation theory often does not explain the acculturation of recent immigrants, many of whom are from Latin American or Asian countries. In lieu of completely losing their own cultural and ethnic identities, these recent immigrants often sustain their own identities (Portes & Zhou, 1993; Zhou & Bankston, 1995; Yancey, 2003). Another claim is that the length of stay of immigrants in the host country is not significantly related to their assimilation and social mobility; instead of getting more blended into the mainstream society, the second-generation immigrants are even at risk of being marginalized in the society (Gans, 1996).

Oppositional Assimilation (Downward Assimilation) Theory

Since 1965, the classic straight-line assimilation theory, along with its application to recent immigrant groups from non-European countries, has been challenged (Zhou, 1997). Researchers found that some immigrants, as their generations pass, realize that complete assimilation to the mainstream American society may be much more difficult and take longer than they originally anticipated (Kao & Tienda, 1995; Waldinger & Perlmann, 1998; Brown & Bean, 2006; Covington Clarkson, 2008; Rong & Preissle, 2009).

Upon recognition of the glass ceiling and obstacles toward social mobility, some of these non-European, non-white immigrants choose to integrate into the underclass of American society. Researchers call this phenomenon as "downward assimilation" or "oppositional assimilation" (Portes & Zhou, 1993; Brown & Bean, 2006).

In regard to education, oppositional assimilation predicts that the first-generation children will outperform their second-and-plus generation counterparts because of cultural effect of their homeland (e.g., morals and values toward education) and strong parental influence (e.g., expectation toward upward mobility through education). As generations pass, the second-and-plus generation children become aware of various social barriers of the host country and intentionally become more assimilated into the social underclass (Portes & Zhou, 1993).

There are reasons why some immigrants show oppositional assimilation. Unlike descendants of European immigrants who were categorized as "white," Asian, Latin American, or African origin immigrants are forced to face various social barriers (Portes & Zhou, 1993; Waldinger & Feliciano, 1998). First, these immigrants often confront racism of labeling (Waters, 1996; Brown & Bean, 2006). For example, black immigrants

from West Indian or African countries are often classified and called "black Americans," no matter how well educated and fluent in English they are. This labeling is said to make them feel different and detached from the white-dominant mainstream of American society (Gibson, 1988; Portes & Zhou, 1993). Consequently, children of these black immigrants may drift apart from formal education and join gangs (Portes & Zhou, 1993; Waters, 1996). Moreover, attending poorly-financed schools, these immigrant children have less chances of being provided with higher-quality education (Villegas, 2004). As a result, as generations shift, their academic achievements tend to be lower than the achievements of their white counterparts. Even worse, due to changes in domestic and international economic structures and conditions, –less-educated and lower-skilled immigrants now have much fewer chances of moving up the social and economic ladder (Waters, 1996). Second and later generations of these colored immigrants, therefore, inevitably fail to increase their social mobility.

This oppositional assimilation seems applicable not only to black immigrants but also to Asian or Latin immigrants. For instance, according a study by Kao and Tienda (1995), second generation Hispanic children tend to have less aspirations for college, and second generation black immigrants also tend to have lower grades than their first generation counterparts. Telles and Ortiz (2008) predict that Mexican immigrants, even after their fourth generations, may continue to show low achievement and a high dropout rate. Zhang (2003) also found that the first and second generations of Asian immigrants generally outperform the third generations. In addition, Saran (2007) argues that not all second or later generation Asian immigrant students do better than their first generation counterparts. He argues that there are still some low-achieving second generation Asian Indian immigrants in American schools because of peer pressure, stereotyping, and poor resources from their families and schools.

One criticism of this theory is that assimilation and upward mobility of these non-white immigrants may be simply delayed, rather than blocked, because of dull economic growth (Bean et al., 2007). For instance, due to today's world economic crisis, non-white immigrants and white, native-born Americans alike experience difficulty finding proper the resources required for upward mobility. These resources can include funds for higher education, well-paid jobs, and even a welcoming social atmosphere.

Segmented Assimilation Theory

Many recent studies show that the assimilation patterns of recent immigrants tend to be much more diversified than what was explained by either classic straight-line assimilation theory or downward assimilation theory (Portes & Rombaut, 2001; Brown & Bean, 2006). Portes and Zhou (1993) introduced the concept of "segmented assimilation" to explain the diverse assimilation phenomena of current immigrants. Segmented assimilation theory offers the premise that American society has become extremely diverse and segmented (Greenman & Xie, 2008). The segmented assimilation theory focuses on identifying various factors: contextual, structural, cultural, and individual. Combined, these factors can boost, delay, or aggravate the acculturation of immigrants (Brown & Bean, 2006).

In lieu of expecting a uniform process of either successful adjustment with longer exposure to American society or oppositional assimilation because of social barriers, the segmented assimilation theory argues that "adaptation is contingent on the geographical location, social class of the family of origin, race, and place of birth" (Hirschman, 2001). Moreover, segmented assimilation provides a comprehensive framework for understanding the differences in various research findings about different educational

attainment as well as adaptation patterns of various immigrant groups (Portes & Zhou, 1993; Zhou, 1997; Hirschman, 2001; Portes & Rombaut, 2001; Schwartz & Stiefel, 2006). These differences may be attributed to various factors such as the social and political context in which immigrant groups are accepted and personal situations (e.g., generation status, race/ethnicity, language competence, and parental SES). As a consequence, the academic achievement of immigrant students appears to be different between immigrant groups, and even within a single immigrant group of the same race/ethnicity. In other words, segmented assimilation theory can be viewed as a "broad perspective" (Greenman & Xie, 2007) that accounts for why different patterns of assimilation appear among recent immigrant groups and how these patterns eventually affect "the destinies of convergence or divergence" (Zhou, 1997).

Among the various factors, generation status distinctively affects the academic achievement of immigrant students in combination with other elements such as race/ethnicity. Although there still are some exceptions, more recent studies show that second generation immigrant children generally outperform not only native-born Americans, but also their first generation counterparts. This phenomenon may be due to the fact that second generation immigrant children are often more fluent in English and have strong parental and communal support (Kao & Tienda, 1995; Kao, 1999; Schwartz & Stiefel, 2006). In other words, second generation immigrant children will achieve social mobility more easily through the use of "the resources linked to their parents" (Waldinger & Perlmann, 1998).

For instance, according to Portes and Zhou (1993), in Florida, where a large and strong Cuban community dominates, the Cuban immigrant children (particularly the second generation) often show better academic achievement than native-born, white Americans or other immigrant groups. Many first generation Cuban parents who came to

the United States around 1965 were well-educated and had professional jobs back in Cuba. Therefore, their expectation of their children's education was naturally high. In addition, U.S. policy toward them was quite affirmative at that time. Thus, Cuban immigrants could build a large and solid community in Florida. These favorable contexts, combined with Cubans' English competence, make it possible for second generation Cuban immigrants to excel in academic performance beyond comparable first and third-plus generation immigrants.

Besides Cuban immigrants, other Asian second generation immigrants such as Chinese, Indian, and Korean also show excellence in academic achievement, based upon their competence in English, and parental and communal pressure (Yang, 2004). For instance, according to Choi and her colleagues (2001), second generation Korean immigrants tend to "adopt the best of both their Korean and American experiences while maintaining their Korean ethnic culture." Being advantaged from both sides, second generation Korean immigrants tend to have better academic achievement than their counterparts or other ethnic immigrant groups.

Likewise, more advantaged immigrant groups, such as Cuban immigrants in Florida and Asian immigrants, tend to preserve not only their traditional values and attitudes but also the language of their home country, despite shifts between generations. Cuban immigrants in Florida even utilize the strong social network of their Cuban community as a means to swifter and easier social mobility for themselves and their children (Portes & Zhou, 1993). Kao and Tienda (1995) called this phenomenon "accommodation-without-assimilation" and Portes and Zhou (1993) called this "selective assimilation"—maximizing their assimilation in the mainstream of the host society by sustaining and utilizing their original culture and community in the United States.

However, not all individual second generation immigrant children (e.g., Cuban, Asian) are outperformed. Depending upon their race/ethnicity, residential location, and other factors, some second generation immigrants underperform. These less successful immigrant children often lack strong communal support and have lower pressure from parents and peers toward higher education and social mobility. For instance, as mentioned in oppositional assimilation section above, the second generation Haitian immigrants, who reside in the same city of Miami as the Cubans, often show lower achievement than any other groups in school since their ethnic community does not have a strong communal cohesion to provide them with protection from various social discriminations (Portes & Zhou, 1993). Consequently, in lieu of blending into the mainstream, they intentionally choose to be a member of the lower class of American society.

English Proficiency of Immigrant Students and Their Achievement

Immigrant students, particularly first- and some second-generation, are not generally fluent in English. Immigrant children who are not fluent in English are often called "Limited English Proficiency" (LEP) students. The number of LEP immigrants is rapidly growing in American schools (Garrett & Holcomb, 2005). In 2004, about five million LEP students were enrolled in American K-12 schools (Batalova, 2006) and the number is increasing. As English proficiency is regarded as a prerequisite for academic success, NCLB also emphasizes LEP immigrant students' attainment of 100% English proficiency (Garrett & Holcomb, 2005).

Studies have suggested that bilingual education is more effective at enhancing LEP students' learning than English-only classes (De La Garza & Medina, 1985; Slavin &

Cheong, 2005). According to these studies, LEP students who attend bilingual classrooms tend to outperform those who take English-only courses. However, in reality, it is almost impossible for LEP immigrants to sufficiently master the English language in such a short period of schooling to take a high-stakes test. Moreover, schools also suffer from the pressure of securing resources, hiring qualified professionals to develop curricula and programs, and teaching LEP immigrants. Therefore, it is almost impossible for LEP immigrants to read and speak English as fluently as their native-born counterparts. Along with lack of English proficiency, immigrant students naturally fail to meet annual progress goals reading as well as other subject areas, such as math and science (Abedi, 2002; Abedi, 2004; Garrett & Holcomb, 2005; Abedi et al., 2006).

Moreover, among LEP students, Asian immigrants and other ethnic minorities who speak languages other than Spanish tend to be marginalized in school (Redondo & Aung, 2008). Despite the traditional myth about high levels of academic achievement among Asian immigrant students, many first-generation Asian immigrants are left behind in American schools. One reason for this phenomenon is that, unlike the Hispanic cases, there are few qualified teachers who can successfully teach Asian immigrants in a bilingual classroom (Redondo & Aung, 2008). For example, Hmong immigrant children in Saint-Paul public schools, many of whom are English language learners, are likely to score below average in the state's mathematic assessment (Watkins, 2006). Because English proficiency is highly related to overall academic achievement, it is necessary to help immigrant students to reach their full potentials in academic assessment by providing them with appropriate resources.

Policy and Political Perspectives on Immigrant Education

The United States is traditionally a country of immigrants. From the first Pilgrims to the recent influx of immigrants from Latin American and Asian countries, it goes without saying that the country was built upon the endeavors and achievements of immigrants. According to the 2000 Census, there are 32.5 million foreign-born people in the U.S. In other words, about one in ten Americans was born abroad (Farenga & Ness, 2005). Moreover, children of immigrants comprise "the fastest growing" and "most ethnically diverse" segment of the total U.S. student population (Zhou, 1997).

Before the mid-1900s, most immigrants, including the Pilgrim Fathers, emigrated from European countries. Thanks to cultural and biological similarities, such as skin color, the early immigrants had relatively fewer difficulties in blending into American society. However, after the mid-1900s, particularly since the amendment of the Immigration and Nationality Act of 1965, an enormous number of people have emigrated from Latin American and Asian countries. Immigrants from these non-European countries share relatively little things in common with white native-born Americans. Therefore many of these non-white immigrants have found it difficult to succeed in upward social mobility as well as acculturation into the mainstream (Portes & Rumbaut, 2001). Consequently, many of them remain in the lower stratum of society, which causes various social tensions and potential conflicts between immigrants and native-born Americans.

Due to this tidal wave of immigration, American people are concerned about the broadening social gaps between immigrants and themselves. Hence, public education naturally began to be emphasized as a means to solve these current and possible social issues related to immigrants. Immigrant students have various cultural and linguistic

backgrounds which are often quite different from that of U.S. students. Due to vast differences, immigrant children often fall into one of the disadvantaged student groups. One example is the limited English proficiency (LEP) student group. In American schools, there are about 5.5 million LEP students who speak a total of more than 460 different languages. Nearly eighty percent speak Spanish. About 4.9 million out of a total of 5.5 million are from immigrant families. One surprising thing is that about eighty-five percent of LEP students are legal US-citizens.

Through education, policy-makers and researchers have anticipated that many issues related to immigrant children can be solved. They expect the NCLB to not only improve immigrant students' language abilities, but also to raise overall academic achievement, which is important for social assimilation and mobility.

Immigrant Education before NCLB

In general, immigrant education largely relies on two leading hypotheses: classic assimilation and segmented assimilation, or pluralism (Ogbu, 1991, Portes and Rumbaut, 2001; Rong & Preissle, 2009). While the classic assimilation theory was popular before 1965, the segmented assimilation or pluralism has attracted public attention ever since. The classic assimilation theory claims that immigrants can successfully adjust to their new countries by giving up their own cultures and languages. However, the segmented assimilation theory encourages immigrants to maintain their own cultures and languages so that the country can become more diversified. In addition, this helps immigrant children feel more secure and welcome within the new environment (Rong & Preissle, 2009).

In accordance with the recent influx of immigrants, the Elementary and Secondary Education Act (ESEA) was enacted in 1965 and amended in 1968 to include the so-called Bilingual Education Act. It was the first law that was established to reflect the situation of immigrant students. In other words, it admitted the particularity of each immigrant student. This shares the same line of thinking as the segmented assimilation or pluralism theory. As a result, the law ensures bilingualism in American public schools to promote better communication between immigrant and native-born American students, or the immigrant students and their teachers. Policy-makers believed that as long as immigrant students can speak fluent English, the academic achievement gaps between the two groups would be narrowed. However, year-by-year, the gap never seemed to narrow. What is worse, dropout rates of these immigrants increased as well (Rong & Preissle, 2009).

With great concern about the widening educational disparity between native-born and immigrant children, an extended and amended version of the ESEA of 1965, the No Child Left Behind Act (NCLB) was legislated in 2001. Since the NCLB is a modified version of the ESEA, it renders rights to decide how and what each school district provides immigrant students, supporting schools and school districts to try any effective programs to improve their academic achievements.

Immigrant Education under the Era of NCLB

Because of a record-high inflow of immigrants, the recent demographic trend of American schools is rapidly changing. In part, the NCLB Act was implemented simultaneously with the dramatic demographic changes. This was out of concern that not only do immigrant children experience difficulties adjusting to the American school

system, but the schools also struggle to adjust to teach them according to their needs. Therefore, the law stipulates American schools must provide "reasonable adaptations and accommodations" for immigrant students (Kuenzi, 2004). However, since the enactment of the NCLB, there have been heated debates over the impact of the law on their academic performance and the achievement gaps between immigrant and native-born children.

Titles I and III (a modified version of ESEA Title VII) of NCLB explain what is required regarding immigrant education. Title I mandates schools to improve the academic performance of all students, including immigrants. The law protects various types of disadvantaged students such as racial and ethnic groups, those from low-income households, and students with special educational needs. Often, immigrant students fall into at least one of these categories. Title I also requires that schools report the test results of students from these subgroups and take responsibility for improving their academic performance. As a result, schools that do not meet the requirements over a certain period are subject to sanctions, including allowing parents to send their children to another school, reduced financial aid from state or federal government, or the worst scenario, the closing of the school.

Another part of Title I of the NCLB encourages the active inclusion of parents. In all aspects of the NCLB, immigrant parents have the same rights as those of the native-born students to be informed about their children's academic performance and progress. However, this assumes that parents are proficient in the English language as well as knowledgeable about the education system. Yet, this poses a challenge to many of these parents, as they are not fluent in English. In addition, both parents tend to work during the day, which prevents them from visiting the school and communicating with the teachers about their children's academic performance (Portes & RomBaut, 2005). As a

consequence, immigrant parents and their children become marginalized or "left behind," in the American education system (Portes & RomBaut, 2005; Rong & Preissle, 2009.

Title III, a modified version of the Bilingual Education Act of 1968, is another part of the NCLB also related to immigrant education. The purpose of Title III is to ensure that students with limited English proficiency not only develop their English abilities, but also meet the same achievement standards as other children. Policy makers believed if immigrant students became fluent in English, their academic performance and motivation would increase accordingly (Kuenzi, 2004). Therefore, to provide well-designed and appropriate language programs to immigrant children, NCLB requires school districts to test students' English abilities. Then the schools should decide whether to include immigrant students with limited English proficiency in regular classrooms or to provide them with other supplementary programs such as English as a Second Language classes. According to Title III, schools also have to determine whether to have immigrant students take the standardized assessment to ensure their English abilities and academic achievements have improved. However, in reality, without adequate readiness, schools exclude these students from the assessment in order to maintain the schools' average scores.

As mentioned above, NCLB aims to promote equal educational opportunities and higher levels of academic achievement for all students, including immigrant students, who are often disadvantaged and limited in English-proficiency. Despite its positive aims for public education, NCLB has received a great deal of criticism. There are few people who are pro-NCLB, and most of them are policy makers of the Bush administration. For instance, Rod Paige, the former Secretary of Education, strongly claimed in his 2002 article that NCLB would be successful because it had positive results in Texas. However, just as Portes and Rumbaut (2005) argued that "educational policies that do not work

well with native-born children may also not work well with immigrant children," more people are skeptical about both the practice and impact of NCLB because of its "one size fits all" standards (Rong & Preissle, 2009). Other studies indicate that the law has neither improved the academic performance of immigrant students, nor has it narrowed the achievement gaps between native-born and immigrant students (Fix & Capps, 2005; Lee, 2006).

Frequently, immigrant children, and even the children of immigrant parents (i.e., the "second-generation") take several years to gain adequate levels of proficiency in English, or to acculturate themselves into the American culture (Klesmer, 1994). However, curricular and instructional practices emerging under the NCLB may be counterproductive to the needs of immigrant children and their schools in this regard. Specifically, instead of diversifying and assisting immigrant students' experiences based on their needs, the NCLB standards may narrow the curriculum to certain subject areas (e.g. reading, math, and science) covered by standardized tests (Rong & Preissle, 2009). Further, reports indicate that the NCLB may be responsible for higher dropout rates among some immigrant groups (Noguera, 2005). In addition, NCLB has been criticized for ignoring variations in school quality. Across the nation, schools differ in terms of resources and context: some schools can provide well-designed bilingual programs while others do not even offer separate ESL classrooms due to a lack of funding and community support. In reality, the NCLB may work against its stated goals even though the policy was ostensibly enacted to help immigrant children. Because of poorly abided policy in the current educational system, disadvantaged and poor immigrant children fall further behind (Rong & Preissle, 2009).

NCLB and Immigrant Students' Academic Achievement

Since its enactment, many studies concerning the effectiveness of the NCLB have been conducted. Although some studies show favor towards the effectiveness of the law (Paulson, 2009), many others report that achievement gaps between native-born American and immigrant students still exist (Capps et al., 2004; Dillon, 2009). In addition, even after NCLB, dropout rates of immigrant students still tend to be higher than that of native-born students (Ruiz-de-Velasco & Fix, 2000; Capps et al., 2004; Ho, 2005).

As the Hispanic population is the largest and fastest growing ethnic group in the United States, Hispanic students often become the research target of many studies (Fry, 2007; Rong and Preissle, 2009). The Hispanic population was 9.5 million in 1970s, but rose to 42 million in 2005 (14.5 % of the total US population) and is expected to reach 105 million by 2050 (25% of the total US population) (Rong and Preissle, 2009). In addition, about 75 % of the Hispanics are either first- or second-generation immigrants (Johnson et al., 2001). Therefore, the performance of Hispanic immigrants in American schools has attracted many researchers' attention. For instance, Chang (2006) argues that Hispanic students, who are often either first- or second-generation immigrants, show low math achievements among various racial groups. Moreover, he claims that due to their low achievements in school, Black and Hispanic students are increasingly isolated from white students in the public schools. Bouchey and Harter (2005) found Hispanic students achieved lower mean levels of academic performance and perceived competence in mathematics and science than did the native-born white students. Furthermore, even other researchers who studied non-Asian (usually Hispanic) immigrants report that those immigrant students relatively underperform in mathematics/science as compared with their native-born, white counterparts. Fry (2007) also shows that there is a large

achievement gap between LEP and native-born students in mathematics and reading proficiency. According to Crosnoe and his colleagues (2004), Mexican immigrants, who did persist in the pipeline or have lower achievements in it, are less likely to enter postsecondary educational institutions and high-status fields of study in these institutions.

Differently from Hispanic immigrants, American people have a solid stereotype impression about Asian immigrant students: they are hard-working and good at mathematics. However, in reality, many Asian immigrants, particularly first-generation, are struggling to survive in the new country (Redondo & Aung, 2008). Under the era of NCLB, many first-generation Asian immigrants are categorized as LEP students and put under supervision of special education (Capps et al., 2004).

The number of recent Black immigrants is very small and mostly from the Caribbean countries such as Jamaica, Haiti, and West Indian Islands. First generation of these Black immigrants tend to outperform native-born African American students (Model, 2008; Healey, 2008). However, as generations pass, children of these immigrants tend to blend into African-American groups. The so-called "hostile reception" of the host country and lack of resources result in low academic achievement of many of the second and following generations of these Black immigrants (Healey, 2008; Stepick & Stepick, 2009).

Summary

Has NCLB constructively affected the academic achievement of many immigrant students enrolled in American schools? This was the main research question of this study. From extensive literature review, I found that the policy, in combination with other factors, somewhat affects the academic achievements of immigrant students.

At the very beginning, the goal of NCLB was that all students can equally reach certain levels of academic achievement regardless of their social, racial, economic, and even immigrant status. However, as seen in the previous sections, NCLB has not positively affected the education of all immigrant students. Although there are some groups of immigrant students who were benefited by NCLB and increased their academic performance, a much larger number of immigrant students still suffered from poverty at home, lack of resources, and difficulties to acquire proficiency in English.

The relationship between assimilation and educational attainment of immigrant children has been the focus of heated debates since different immigrant groups show different academic outcomes as well as assimilation patterns. According to the literature, assimilation process can be influenced by two major factors: personal competence and circumstantial favorability. Personal competence of immigrants refers to what the immigrants possess before entering host societies, such as wealth, language ability, job skills, and education level. Circumstantial favorability means the situation of host societies at the time the immigrants moved into the new countries, such as policies, economics, and social structure (Ogbu, 1991; Portes & Zhou, 1993; Zhou & Bankston, 1995; Portes & Rumbaut, 2001; Brown and Bean, 2006; Zhou & Lee, 2007). These factors, in combination with each other, can affect the extent to which immigrants become successfully acculturated to their host societies.

Although there are different perspectives about immigrant children's assimilation, segmented assimilation theory is relatively widely accepted these days. According to segmented assimilation theory, although there are some variations, in general, first and second-generation immigrant children outperform third and following generations or native-born white Americans. Among them, regardless of ethnicity/race, those belonging to the second generation generally outperform other generations.

CHAPTER III

METHOD AND DATA

Source of the Data

Data used in this study were drawn from the Trends in Mathematics and Science Study (TIMSS) 2003 and 2007. TIMSS is an international assessment designed by the International Association for the Evaluation of Educational Achievement (IEA), for the comparison of students' academic achievement worldwide, every fourth year. Among different datasets of national or international assessment for educational achievement, such as National Assessment of Educational Progress (NAEP) and Program for International Student Assessment (PISA), TIMSS (particularly of 2003 and 2007) was chosen due to the following reasons: First, TIMSS 2003 and 2007 include two key variables (immigrant generation status and race) that are necessary to attain the research goals of this study. Second, the year 2003 was the early stage of the implementation of NCLB, whereas the policy had been ripe for the next four years and reached its plateau.

Comparison of the TIMSS 2003 and 2007 assessment results may enable us to infer the possible influence of the law: whether it had narrowed or widened the achievement gaps of students. Third, by using the results of this research as the bedrock, future studies can aim for a longitudinal study to probe the U.S. trend of achievement gaps among different immigrant generation and race groups of students. Finally, in line with its original purpose of international comparison, one can benchmark the U.S. results with those of other countries that host increasing numbers of immigrants.

Among the four TIMSS assessments, TIMSS 2007 shares the same assessment framework with TIMSS 2003 (Mullis et al., 2005; Williams et al., 2009) and half of the content and cognitive domains of TIMSS 2003 are reflected in TIMSS 2007 (Williams et al., 2009). In the same sense as TIMSS 2003 and 2007, TIMSS 2011 will share the same assessment framework and the other half of the content and cognitive domains of TIMSS 2007 (Williams, et al., 2009). The IEA developed the TIMSS tests in order to compare and examine the progress among and within the participating countries. Furthermore, among the four TIMSS assessments of 1995, 1999, 2003, and 2007, only TIMSS 2003 and 2007 contain race variables released to the public. Race variables in TIMSS 1995 and 1999 are restricted and only available to the licensees. In terms of accessibility, inclusion of TIMSS 1995 and 1999 was left for a future study.

The samples of TIMSS 2003 and 2007 were collected in a stratified, multi-level sampling design (Williams, et al, 2009). The theoretical samples of TIMSS 2003 and 2007 should have been obtained from 300 nationally represented schools. In reality, however, including replacement schools (21 for 2003 and 42 for 2007), 232 schools for TIMSS 2003 and 239 schools for TIMSS 2007 were randomly selected and finally participated in the assessment (Mullis, et al 2005; Olson, et al, 2008; Williams, et al, 2009). Once selected, the participating schools submitted a list of classrooms. All students in the classrooms should have been assessed apart from some students who were categorized as "students in special need" (Foy & Joncas, 2004). These students are often those who have intellectual disabilities or who don't have a high enough proficiency in English to conduct the test (Foy & Joncas, 2004). The final weighted student-level response rate for TIMSS 2003 and 2007 was 94 percent (Kastberg, et al., 2005) and 93 percent (Joncas, 2008; Williams, et al., 2009), respectively. In this way, a total of 9,891 eighth-grade students were sampled and 8,912 actually participated in TIMSS 2003.

Likewise, in TIMSS 2007, 7,377 out of 8,447 eighth-grade student samples were assessed. After cleaning up the data, the de facto sample sizes extracted from TIMSS 2003 and 2007 for this study were 8,904 and 7,377 respectively.

Variables of Interest

Immigrant Generation Status

One goal of this study is to examine achievement gaps among students from different generations of immigrant groups; therefore, it is necessary to clearly define immigrant generations. In general, first-generation immigrant refers to those who were born outside of the U.S. Second-generation students are those who were born in the U.S. to at least one parent who was not (Chriswick & DebBurman, 2003; Capps et al., 2005; Rong & Preissle, 2009). Accordingly, third-generation (or native-born) students and their parents were born in the U.S.

In TIMSS 2003 and 2007, there are some variables that contain information about the nativity of participating students and their parents: BSBGBRN (2003) and BS4GBORN (2007) for student's nativity, BSBGFBRN (2003) and BS4GFBRN (2007) for father's nativity, and BSBGMRN (2003) and BS4GMBRN (2007) for mother's nativity. By using these three variables, new dummy variables for immigrant generation status were created: GEN1 (first generation=1), GEN2 (second generation=1), UNKGEN (unknown generation=1). Table 1 represents how each combination of the three nativity variables was classified. For the sake of convenience, cases in which students were foreign-born

while their parents were U.S.-born were categorized into the third/native-born generation.[1]

Table 3. 1 Immigrant Generation Status

	Father	Mother	Child	Immigrant Generation
Nativity	X	X	X	First generation
	X	O	X	First generation
	O	X	X	First generation
	X	X	O	Second generation
	X	O	O	Second generation
	O	X	O	Second generation
	O	O	X	Third/Native-born generation
	O	O	O	Third/Native-born generation

Race

Race is often a highly related factor in academic achievement gaps. Traditional studies about race and academic attainment revealed that black and Hispanic students often underperform compared to their white or Asian counterparts (Lee, 2002). Moreover, more recent studies reported that race, in combination with immigrant generation status, may affect academic attainment of students (Ogbu, 1991; Kao & Tienda, 1995; Rong & Preissle, 2009). Therefore, race variables in TIMSS (MSRACE: 2003 and ASRACE: 2007) were included in this study as key variables for analysis. The original race variables had scales from 1 to 6 (2003) or 1 to 7 (2007) to classify the different race

[1] Although they were not born in the U.S., at the time of participating in the assessment, they were in the U.S. with a strong familiarity with American culture and English language enough to be compatible with their third/native-born counterparts.

groups. From each race variable, six or more separate dummy variables, including ones for the "race-unknown" cases, were created as shown in Tables 2 and 3.

Interaction of Immigrant Generation Status and Race

To control the interaction effect of immigrant generation status and race, six dummy variables were created: G1B (GEN1*BLACK), G2B (GEN2*BLACK), G1H (GEN1*HISPANIC), G2H (GEN2*HISPANIC), G1A (GEN1*ASIAN), and G2A (GEN2*ASIAN). These dummy variables were created as they represent the product of two different dummy variables. Since this study focuses on three race groups (black, Hispanic and Asian), dummy variables for the interaction effects were made only for these three race groups.

Control Variables

In addition to the two variables of interest above, other control variables were included at both student and school levels. After exploratory analysis, three student-level and eight school-level control variables were either selected or generated.

Student-Level Control Variables

After several exploratory analyses, three controls were finally retrieved from the TIMSS 2003 and 2007 data and recoded into the new variables. Student-level controls include gender (GENDER), highest level of parent's education (PARENTED), and frequency of English usage at home (HOMELANG).

For a long time, gender differences on academic achievement, particularly in math, have been extensively studied by educational researchers. Many previous studies showed there are gaps in math achievement between male and female students: usually boys outperform girls (Friedman, 1989; Fan et al, 1997; Bassey, Joshua, & Asim, 2009). Therefore, a GENDER (female=1) variable was included to control any variance from different gender composition of each immigrant and race group.

As a control for students' socioeconomic status (SES), the mother's level of education was used. Since there is no variable in TIMSS that directly indicates parental income, students' SES only be inferred from the mother's education level. Parents' education level is highly correlated with students' academic achievement, thus it is a good proxy for SES (Mark, 2008). PARENTED variables originally had a scale from 1 to 9 (TIMSS 2003) and 1 to 7 (TIMSS 2007) in accordance with the International Standard Classification of Education (ISCED): 1 indicates elementary level education and 9 (TIMSS 2003) or 7 (TIMSS 2007) means beyond a bachelor's degree.

The effect of proficiency in the English language on academic achievement is another factor that needed to be considered. Research showed high correlation with English language ability and mathematic attainment (Wang & Goldschmidt, 1999; Fakeye & Yemi, 2009). For example, second-generation immigrant students, who are fluent in English but do not speak English at home as frequently as their native-born counterparts, showed the highest math scores. On the other hand, many of the first-generation students, who are not fluent in English and do not speak English at home, attained the lowest average math scores (Stiefel et al., 2003). Thus, frequent usage of English at home (HOMELANG) was also included as the last student-level control. The inclusion of these control variables increases our ability to tease out the distinctive links between generation status and school achievement.

School-Level Control Variables

Previous research showed statistically significant effects of school composition on minority students' academic achievement, such as African Americans, Hispanics, or immigrant students (Rumberger & Palady, 2005; Ryabov, 2005; Osagie, 2007). Therefore, it was necessary to control the possible influence of the demographic and socioeconomic characteristics of participating schools.

Although there are pre-existing variables in the TIMSS data (e.g., percentage of students offered free lunch and whether it is a private or public school) that are helpful indicators for a schools' socioeconomic situation, they were removed from the analysis after an exploratory analysis because 1) they include a substantially large number of missing cases, and are thus not appropriate for Hierarchical Linear Modeling (HLM) and 2) some of them showed no statistical significance in the exploratory analysis. Therefore, I created the substitutes from existing variables to control school-level influences. From aggregations of race, immigrant generation status, and socioeconomic variables by school ID, average composition of race and immigrant generation groups (PCTBLACK, PCTHISP, PCTASIAN, PCTGEN1, PCTGEN2, PCTG1H, PCTG2H) and the mean of the mother's highest level of education (PCTPED) per school were computed.

Dependent Variable

TIMSS decided to minimize the "test burden" of participating students by limiting the number of assessment items per student (Williams et al., 2009). To probe achievement

gaps, five separate plausible value mathematics scores (BSMMAT01~05) in TIMSS 2003 and 2007 data were used. The TIMSS assessment includes different forms of math and science scores such as plausible value score, raw score, standardized score, and Rasch score. Among the different types of achievement scores, the estimate of five plausible value math scores was used as the dependent variable as recommended by IEA. Between math and science scores, math scores were chosen because they tend to show a higher correlation with other subject areas (Shouse, 1998). HLM can calculate the estimation from up to five plausible values. Therefore, there is no problem when using plausible values for multi-level analysis. However, the Statistical Package for the Social Sciences (SPSS) cannot compute plausible values. Therefore, I ran five separate weighted regressions with the five plausible values. For the student-level OSL regression result, the outcome of the first plausible value was used as a proxy (Wu, 2004). However, the Statistical Package for the Social Sciences (SPSS) cannot compute plausible values. Therefore, I ran five separate weighted regressions with the five plausible values. For the student-level OSL regression result, the outcome of the first plausible value was used as a proxy.[2]

Missing Data

A large-scale social science data resource such as TIMSS often includes missing values in some variables (Willms & Smith, 2005). The missing data can produce an outcome that appears to have come from a biased sample (Wayman, 2003). Therefore, to obtain unbiased and more accurate analysis results, missing data should be properly treated. In lieu of simply deleting missing cases, two other methods were adopted in this

[2] The detailed regression outcomes of each five plausible value from OLS regression can be seen in the appendix.

study to handle missing data: mean substitution with dummy variables (Willms & Smith, 2005), and replacement with predicted values from regression. For the variables of interest, immigrant generation status and race, a dummy variable (NOGEN = 1) was created to replace missing data. For other control variables, regression estimates took the place of missing cases. For detailed regression coefficients, see the Appendix.

Data Analysis

TIMSS data requires application of the Jackknife Repeated Replication (JRR) method to calculate the sampling error and standard error (Martin et al., 2004). However, computing with JRR isn't accessible to all users, due to its complexity. Thus, IEA developed an analysis module called IDB Analyzer to facilitate more precise and effortless analysis of large-scale international data such as TIMSS and PISA. However, the analyzer can compute only a maximum of 10 variables at a time using the JRR method. As a result, using the IDB analyzer was not used beyond the exploratory stages. Instead, SPSS was used for descriptive analysis and OLS regressions while Hierarchical Linear Modeling (HLM) was used for multi-level analysis.

Although OLS regression with SPSS may not guarantee as accurate a computation result as the IDB analyzer, if the proper weights provided for TIMSS are applied, the estimates of the standard errors become quite close to those obtained using the JRR procedure (Willms & Smith, 2005). Table 2 presents the sampling error and standard error computed and provided by IEA.[3]

[3] See http://www.iea.nl/iea_studies_datasets.html

Table 3.2 Summary Statistics and Standard Error [4]

		Sample Size	Mean Proficiency	Standard Deviation	Jackknife Sampling Error	Overall Standard Error
2003	Mathematics	8,912	504.366	79.993	3.270	3.309
2007	Mathematics	7,377	508.454	76.736	2.773	2.830

To examine the effects of immigrant generation status and race on academic achievement gaps, a three-phase stepwise analysis was employed. As a first step, Statistical Package for the Social Sciences (SPSS Version 18.0 for Windows) was utilized for the descriptive analyses. The descriptive analyses offered ground information about the variables for further analysis. In the second phase of the analysis, I developed a stepwise ordinary least squares (OLS) regression model by using SPSS to explore the effects of student-level variables on math and in the TIMSS assessment. As noted above, SPSS cannot calculate plausible value math scores using the JRR procedure nor can it analyze a data with stratified structure. As a consequence, the first plausible value of the dependent variable and a student weight (TOTGWT) were used. Although using one plausible value may produce "underestimated total uncertainty[5]," it still gives more unbiased estimates of population parameters than using the mean of five plausible values (Wu, 2004). In addition, although the OLS regression may not accurately account for the standard errors and the estimates of variance driven from the hierarchical structure of the TIMSS data, it was still worth conducting the OLS regression analysis because it could provide "useful" basic information about the correlation of the variables. It also made it

[4] For 2003 data (Martin et al., 2004) and for TIMSS 2007 (Olson et al., 2008)
[5] See "Manual for the PISA 2000 Database"

possible to determine the inclusion and exclusion of the variables for the next step analysis of HLM (Mussoline, 1998).

For the first step of the OLS regressions, I included race variables and control variables to examine how race is solely related to academic achievement. Then, I added generation variables to see how immigrant generation status affects the math scores of immigrant students. Finally, I included all interaction variables to refine the regression models and to control the interaction effect of immigrant generation status and race.

As noted above, the TIMSS data were collected in clusters and levels. Therefore, in consideration of structural characteristic of the TIMSS data, the third and final step of analysis was to use HLM to probe effects from different levels of the data. In this study, the HLM 6 (Hierarchical Linear and Nonlinear Modeling Program Version 6.00 for Windows) was used to investigate the nested effects (Raudenbush et al., 2004). HLM allows its users to investigate effects both within and between hierarchical levels.

In general, students within the same group tend to share more similar characteristics compared to those outside the group (Bryk & Raudenbush, 1992). To calculate variance in TIMSS test achievements between schools, one-way random-effects ANOVA was adopted (Bryk & Raudenbush, 1992). The predicted variance in math achievement between schools was .234 ($\sigma 2$=1179.26+3850.72/1179.26) for TIMSS 2003 and .32(1724.75+3850.72/1724.75) for TIMSS 2007. This means 23.4 % and 32.0% of the differences in math and science achievement came from the differences between schools.

In respect to substantially large between-school effects, the general HLM model used in this study is specified below:

Student-level equation:

$$(\text{Achievement})_{ij} = \beta_{j0} + \beta_{j1}(\text{Black}=1)_{ij} + \beta_{j2}(\text{Hispanic}=1)_{ij} + \beta_{j3}(\text{Asian}=1)_{ij} + \beta_{j5}(\text{NI/PI}=1)_{ij} + \beta_{j5}(\text{Other race}=1)_{ij} + \beta_{j6}(\text{Unknown race}=1)_{ij} + \beta_{j7}(\text{First generation}=1)_{ij} + \beta_{j8}(\text{Second generation}=1)_{ij} + \beta_{j9}(\text{Unknown Generation}=1)_{ij} + \beta_{j10}(\text{Controls})_{ij} + r_{ij}$$

School-level equation:

$$\beta_{j0} = \gamma_{00} + \gamma_{01}(\text{Public or private})_j + \gamma_{02}(\text{Mean of parent's highest education level})_j + \gamma_{03}(\text{Percent of Black students})_j + \gamma_{04}(\text{Percent of Hispanic students})_j + \gamma_{05}(\text{Percent of Asian students})_j + \gamma_{06}(\text{Percent of first generation})_j + \gamma_{07}(\text{Percent of second generation})_j + \gamma_{08}(\text{Percent of first generation Black})_j + \gamma_{09}(\text{Percent of second generation Black})_j + \gamma_{10}(\text{Percent of first generation Hispanic})_j + \gamma_{11}(\text{Percent of second generation Hispanic})_j + \gamma_{12}(\text{Percent of first generation Asian})_j + \gamma_{13}(\text{Percent of second generation Asian})_j + u_{j0,}$$

In this model, student i is nested within a school j. β ij represents the student level coefficients, whereas γ 0j represents the school level. rij and uj0 are the residuals. In the student-level equation, βj1~ βj9 indicate the coefficients for the variables of primary interest (immigrant generation status and race). βj10 denotes the coefficients of the control variables. Most of the student-level variables were grand-centered while the Hispanic variable (Hispanic = 1) was only group-centered. From an exploratory analysis with HLM, I found the effect of "being Hispanic" on achievement did not have a normal distribution across schools. Therefore, with an assumption that the "Hispanic effect" on

achievement is non-randomly varying across schools, I chose to group-center the variable. At the school level, βj0 stands for the slope of the intercept and γ01j~ γ13j represents the slopes of intercept for other school level variables. uj0 represents any random effects in the school-level model.

CHAPTER 4

RESULTS

As explained in the previous chapter, three separate analysis steps were conducted to investigate the research goal of this study: how immigrant generation status and racial differences affect students' math achievement over time. In this chapter, summary of descriptive statistics for both student- and school-level variables and OLS regressions for the student-level measures will be presented first. To ensure the reliability of the OLS regression result, I compared a partial result of the SPSS OLS regression result with that of IDB analyzer. The results of hierarchical linear modeling analyses will be displayed at the end. All analyses were conducted separately for the TIMSS 2003 and TIMSS 2007 datasets.

Descriptive Statistic Results

Tables 3 and 4 summarize the descriptive results for the variables in TIMSS 2003 and 2007 used for this study. The sample size of student-level was 8799, and for school-level 230, in TIMSS 2003. In TIMSS 2007, 7377 students and 239 schools were selected as the sample. In both sets of data, gender was relatively evenly distributed (M =.48, SD=.50 for TIMSS 2003 and M = .50, SD=.50 for TIMSS 2007). The HOMELANG variables also share similar mean and standard deviation in both years: 3.74 and .63 respectively for 2003, and 3.64 and .69 for 2007. As the mean of HOMELANG is around 3.7 out of a maximum of 5, one can judge there are more English-speaking students in

this sample than non-English-speaking students. In both years, the mean of the variables for highest level of parent's education is around 4 (3.96 and 3.97). As all race and immigrant generation variables were re-coded into dummy variables (if =1, other =0), the percentage of each variable can be estimated from the mean. For example, the percentages of Black students and second generation students in TIMSS 2003 are both about 13%.

As seen in Table 3, the percentage of Hispanic students is the highest at 16% in TIMSS 2003 and 24% in TIMSS 2007. As more Hispanic students were included in the TIMSS 2007 assessment, this Hispanic effect should be taken into careful consideration in later analysis. The mean plausible value mathematics score is around 504 for TIMSS 2003 and 506 in TIMSS 2007.

At school-level, both data sets include more public schools than private schools (M=1.08 and 1.09 if public school =1 or private school=2). School-level means the parents' education levels tend to be very similar to those of student-level in both years (e.g. 3.96 for student-level, and 3.95 for school-level in TIMSS 2003). Other school-level immigrant generation status and race variables are inclined to share similar values with those of the student-level as well in both years. For example, the mean of one Hispanic student per school in TIMSS 2007 is .23, while one Hispanic student at student-level is .24.

Table 4.1 TIMSS 2003 Variable Descriptions and Simple Statistics

Variables	Description	Range	Mean	SD
Student-Level Variables	(N=8799)			
GENDER	Student Gender (0=male, 1=female)	1.00	.48	.50
HOMELANG	Frequency of English usage at home (1=never, 4=always)	3.00	3.74	.63
PARENTED	Highest level of parent's education (1=elementary, 5=more than bachelor's degree)	5.90	3.96	1.14
BLACK	Equals 1 if student is Black	1.00	.13	.34
HISPANIC	Equals 1 if student is Hispanic	1.00	.16	.37
ASIAN	Equals 1 if student is Asian	1.00	.04	.19
OTHER	Equals 1 if student is of other race	1.00	.02	.12
NORACE	Equals 1 if student's race is unknown	1.00	.02	.12
GEN1	Equals 1 if student is a first generation immigrant	1.00	.06	.25
GEN2	Equals 1 if student is a second generation immigrant	1.00	.13	.34
NOGEN	Equals 1 if student's generation is unknown	1.00	.02	.15
G1B	Equals 1 if student is 1st generation* Black	1.00	.01	.07
G2B	Equals 1 if student is 2nd generation*Black	1.00	.01	.11
G1H	Equals 1 if student is 1st generation*Hispanic	1.00	.03	.18
G2H	Equals 1 if student is 2nd generation*Hispanic	1.00	.06	.24
G1A	Equals 1 if student is 1st generation*Asian	1.00	.01	.11
G2A	Equals 1 if student is 2nd generation*Asian	1.00	.02	.14
1st PV Math	TIMSS 2003 Plausible Mathematic Score	507.51	503.72	79.32
2nd PV Math	TIMSS 2003 Plausible Mathematic Score	567.54	504.34	80.79
3rd PV math	TIMSS 2003 Plausible Mathematic Score	518.66	504.76	81.08
4th PV Math	TIMSS 2003 Plausible Mathematic Score	524.46	504.04	80.38
5th PV Math	TIMSS 2003 Plausible Mathematic Score	534.27	504.09	79.72
School Level Variables	(N=230)			
PUBPRV	Public school or private school?	1.00	1.08	.28
PCTPED	School mean highest level of parent's education	2.09	3.95	.41
PCTBLACK	Percentage of Black student by school	.95	.14	.22
PCTHISP	Percentage of Hispanic student by school	1.00	.16	.21
PCTASIAN	Percentage of Asian student by school	.42	.03	.06
PCTGEN1	Percentage of first generation student by school	.60	.06	.08
PCTGEN2	Percentage of second generation student by school	.63	.13	.14
PCTG1B	Percentage of first generation Black student by school	.16	.01	.02
PCTG2B	Percentage of second generation Black student by school	.50	.01	.04
PCTG1H	Percentage of first generation Hispanic student by school	.60	.03	.07
PCTG2H	Percentage of second generation Hispanic student by school	.58	.06	.11
PCTG1A	Percentage of first generation Asian student by school	.25	.01	.02
PCTG2A	Percentage of second generation Asian student by school	.25	.02	.05

Table 4.2 TIMSS 2007 Variable Descriptions and Simple Statistics

Variables	Description	Range	Mean	SD
Student-Level Variables	(N=7377)			
GENDER	Student Gender (0=male, 1=female)	1.00	.50	.50
HOMELANG	Frequency of English usage at home (1=never, 4=always)	3.00	3.64	.68
PARENTED	Highest level of parent's education (1=elementary, 5=more than bachelor's degree)	4.03	3.97	1.10
BLACK	Equals 1 if student is Black	1.00	.13	.33
HISPANIC	Equals 1 if student is Hispanic	1.00	.24	.43
ASIAN	Equals 1 if student is Asian	1.00	.03	.18
OTHER	Equals 1 if student is of other race	1.00	.04	.19
NORACE	Equals 1 if student's race is unknown	1.00	.01	.11
GEN1	Equals 1 if student is a first generation immigrant	1.00	.08	.27
GEN2	Equals 1 if student is a second generation immigrant	1.00	.19	.39
NOGEN	Equals 1 if student's generation is unknown	1.00	.02	.15
G1B	Equals 1 if student is 1st generation*Black	1.00	.01	.08
G2B	Equals 1 if student is 2nd generation*Black	1.00	.01	.11
G1H	Equals 1 if student is 1st generation*Hispanic	1.00	.05	.21
G2H	Equals 1 if student is 2nd generation*Hispanic	1.00	.12	.32
G1A	Equals 1 if student is 1st generation*Asian	1.00	.01	.09
G2A	Equals 1 if student is 2nd generation*Asian	1.00	.02	.14
1st PV Math	TIMSS 2003 Plausible Mathematic Score	503.10	506.12	76.77
2nd PV Math	TIMSS 2003 Plausible Mathematic Score	522.92	506.21	77.85
3rd PV math	TIMSS 2003 Plausible Mathematic Score	487.94	506.15	78.56
4th PV Math	TIMSS 2003 Plausible Mathematic Score	511.43	505.59	78.27
5th PV Math	TIMSS 2003 Plausible Mathematic Score	496.09	507.13	77.19
School Level Variables	(N=230)			
PUBPRV	Public school or private school?	1.00	1.08	.28
PCTPED	School mean highest level of parent's education	2.09	3.95	.41
PCTBLACK	Percentage of Black student by school	.95	.14	.22
PCTHISP	Percentage of Hispanic student by school	1.00	.16	.21
PCTASIAN	Percentage of Asian student by school	.42	.03	.06
PCTGEN1	Percentage of first generation student by school	.60	.06	.08
PCTGEN2	Percentage of second generation student by school	.63	.13	.14
PCTG1B	Percentage of first generation Black student by school	.18	.01	.02
PCTG2B	Percentage of second generation Black student by school	.31	.01	.04
PCTG1H	Percentage of first generation Hispanic student by school	.60	.03	.07
PCTG2H	Percentage of second generation Hispanic student by school	.58	.06	.11
PCTG1A	Percentage of first generation Asian student by school	.20	.01	.02
PCTG2A	Percentage of second generation Asian student by school	.43	.02	.05

Exploratory Ordinary Least Square (OLS) Regression

As the second stage of the analysis, two sets of stepwise regressions for TIMSS 2003 and TIMSS 2007 were run for an exploratory examination about how the variables at student-level are related to math achievement. Before conducting the stepwise analysis, I ran five different regressions with five plausible value mathematics scores from each dataset. Detailed regression results for each plausible value mathematic scores per year are listed in the appendix. The five plausible values showed very similar patterns in terms of regression results. There wasn't any substantive difference in the coefficients of the variables as well as the intercepts. In accordance with the literature (Wu, 2004), first plausible value math score of each datum was chosen as a proxy for the next stepwise OLS regression analysis.

As seen in the tables of Appendix C, all variables appear to be statistically significant in terms of math achievement except for the second generation variable in the model III. As widely known (Benbow & Stanley, 1983; Bielinski & Davison, 1998, Benbow et al., 2000), boys constantly tend to outperform girls ($\beta = 5.82$, $p \leq .001$ in TIMSS2003 and $\beta = 1.28$, $p \leq 0.001$ in TIMSS 2007 in both Model IIIs). However, the beta coefficient of gender variable is 0.04 and 0.01 which can be interpreted as not substantive, for it means only 4% and 1% of one standard deviation difference in math achievement. Frequent usage of English at home also has a positive relation with math achievement ($\beta = 6.01$, $p \leq .001$ in TIMSS 2003 and $\beta = 2.65$, $p \leq 0.001$ in TIMSS 2007). This result coincides with the general literature that students from non-English speaking homes tend to underperform their counterparts from English-speaking homes (Wang & Goldschmidt, 1999; Abedi & Lord, 2001; Zhang, 2008). However, when paying attention to the beta coefficients of the gender and English usage at home variables, one can find Beta equals

to less than 0.1, which indicates that both variables are not substantive. The parent's education level also positively related to higher math achievement ($\beta = 11.67$, $p \leq .001$ in TIMSS 2003 and $\beta = 18.71$, $p \leq 0.001$ in TIMSS 2007). This can be interpreted that students with a better socio-economic background attain higher math achievement. In contrast to other student background variables, the effect of parent's education level has increased from 11.67 to 18.71. The beta of parent's education is 0.17 and 0.27, which means that the highest education level of parents is quite strongly related to math achievement, with a 17% in 2003 and 26% in 2007 of one standard deviation difference.

In this model, the coefficients of race and immigrant generation status accord with the literature. Black and Hispanic students significantly underperform compared to their white counterparts ($\beta = -76.04$ and -39.89.46, $p \leq 0.001$, Beta = -0.33 and -0.18 in TIMSS 2003 and $\beta = -73.17$ and -47.42, $p \leq 0$ .001, Beta = 0.32 and 0 .27) whereas and Asian students tend to outperform any other race groups ($\beta = 14.28$, $p \leq 0.001$, Beta =0.05 in TIMSS 2003, and $\beta = 16.15$, $p \leq 0.001$ Beta=.04 in TIMSS 2007). However, as the beta of the Asian variable is less than 0.1, the effect of "being Asian" should be treated as non-substantive.

Immigrant generation status variables also have negative effect on math achievement. In TIMSS 2003, first generation immigrant students ($\beta = -45.16$, $p \leq 0.001$) tend to underperform much more than their native-born or third-generation counterparts. Moreover, the effect of being first generation, when not considering other factors, is substantive as the beta is more than 0.1 in Model I. As other variables are added, the effect of being a first-generation immigrant disappears. Second generation immigrant students also tend to slightly underperform their native-born/third generation counterparts ($\beta = -.30$, $p \leq 0.001$ in Model IV), but the variation between them is not substantive. In TIMSS 2007, first generation immigrants still underperform their native-

born/third-generation counterparts (β = -33.90, p≤ 0.001 in Model I). Second generation immigrants also underperform their counterparts by β = - 15.97 (p≤0 .001 in Model I). In line with TIMSS 2003, generation effects are not substantive, as the betas of both variables are less than 0.1 when other variables are included.

If one combines the coefficients of race and immigrant generation variables to calculate the estimated math achievement for each race and generation group of students, second-generation Asian students still outperform any other race and immigrant generation group of their counterparts by 15.94 in TIMSS 2003, while first-generation black students underperform by -99.69[6]. In TIMSS 2007, when combining the coefficients of generation and race, second generation Asian students tend to outperform their native-born/third generation white counterparts (45.38[7]), while first generation black immigrant students underperform (-78.44[8]) more than any other immigrant or racial student group.

I ran a regression with the IDB analyzer that included the variables[9] in Model II of the OLS regression, because the IDB analyzer can compute a maximum of 12 variables at a time. As the IDB analyzer utilizes a Jackknife Repeated Replication method in the procedure, it can provide more accurate sampling error and regression results (see appendix for the results from the IDB analyzer). To compare the regression results of the two statistical tools, the coefficients share similar values and patterns. For example, the intercept of the SPSS OLS regression is 443.98, while that of the IDB analyzer is 442.49. The coefficients for Black, Hispanic, and Asian variables in SPSS OLS regression are -

[6] 21.87 (ASIAN) -.30 (GEN2) -5.63 (G2A) = 15.94 and -76.04 (BLACK) -13.05 (GEN1) -10.60 (G1B) = -99.69
[7] 16.15(ASIAN) + 6.24 (GEN2) +22.99 (G2A) = 45.38
[8] -73.17 (BLACK) -5.27 (GEN1) +.00 (GEN1*BLACK) = -78.44
[9] GENDER, HOMELANG, PARENTED, BLACK, HISPANIC, ASIAN, OTHER, NORACE, GEN1, GEN2, NOGEN

73.91, -44.71, and 18.71 ($p \leq 0.001$) whereas those of the IDB analyzer are 73.99, -46.87, and 19.85. The variables for first- and second-generation from SPSS also share similar coefficients with those of the IDB analyzer: -21.25 and .85 ($p \leq 0.001$) vs. -20.57 and 2.77. Note that from this comparison, as Wu (2004) denoted, non-exact, but close-to-exact estimates could be calculated by using a proper weighting and first plausible value.

Hierarchical Linear Modeling

The ordinary least square (OLS) regression models provide intrinsic information about the relationship between students' math achievement and their immigrant generation status as well as race. However, the OLS regressions can provide only student-level analysis results irrespective of school-level effect on achievement. Consequently, the OLS regression results cannot help being influenced. For example, a Hispanic second-generation immigrant student studying in a private school dominated by white students can have better math scores than his counterpart with the same immigrant-generation and racial condition who goes to a Hispanic-dominated public school. Neglecting school-level effect can, therefore, result in biased estimates. Contrary to the OSL regressions, hierarchical linear modeling (HLM) distinguishes student- and school-level effects so that one can identify their separate influences.

HLM analysis in this study includes a step by step investigation. First, the unconditional model was conducted to calculate within-school and between-school effects. Then, three different HLM analyses were done to figure out which student- and school-level variable is influential on math achievement. Detailed results are displayed in Tables 4.3 and 4.4.

Table 4.3

Effect of Generation Status and Race on Academic Achievement (HLM Coefficients, TIMSS 2003)

Variable*	I	II	III
Student-Level Effects			
Intercept	510.84	510.48	500.63
GENDER	5.14 *	5.36 *	5.44 *
HOMELANG	4.18	2.81	3.14
PARENTED	5.60 ***	5.64 ***	5.19 ***
BLACK	-42.32 ***	-42.57 ***	-40.14 ***
HISPANIC	-24.62 ***	-25.38 ***	-27.34 **
ASIAN	4.311	4.41	10.12
OTHER	-19.75	-18.71	-19.41
NORACE	-23.66 *	-23.21 **	-22.52 *
GEN1		-12.40	-18.62
GEN2		4.53	3.81
NOGEN		-15.84	-15.84
G1B			-9.41
G2B			9.52
G1H			10.25
G2H			6.42
G1A			17.93
G2A			-15.26
School-level Effects			
PUBPRV			12.47 *
PCTPED			43.31 ***
PCTBLACK			-38.20 **
PCTHISP			-20.26
PCTASIAN			87.10
PCTGEN1			230.63 **
PCTGEN2			41.14
PCTG1B			-542.02 *
PCTG2B			3.01
PCTG1H			-275.58 **
PCTG2H			-144.33
PCTG1A			-468.58 **
PCTG2A			73.91

* p≤ .05, ** p≤ .01, *** p≤ .001

Table 4.4

Effect of Generation Status and Race on Academic Achievement (HLM Coefficients, TIMSS 2007)

Variable*	I		II		III	
Student-Level Effects						
Intercept	506.39		506.25		502.80	
GENDER	3.51		3.92		3.73	
HOMELANG	2.56		2.59		2.20	
PARENTED	11.49	***	11.63	***	10.68	***
BLACK	-45.15	***	-44.82	***	-40.53	***
HISPANIC	-27.56	***	-28.97	***	-32.18	***
ASIAN	26.84	***	23.36	***	12.29	
NI_IN	-28.86	*	-28.92	*	-28.30	**
PACIFIC	-15.64		-18.47		-19.11	
MIXRACE	-10.20		-11.23		-9.51	
NORACE	-45.82	**	-42.24	*	-39.87	**
GEN1			-8.40		-6.59	
GEN2			10.29	**	6.79	
NOGEN			-18.84		-17.40	
G1B					-4.31	
G2B					5.10	
G1H					1.78	
G2H					11.99	
G1A					17.16	
G2A					15.83	
School-level Effects						
PUBPRV					1.86	
PCTPED					39.23	***
PCTBLACK					-50.22	***
PCTHISP					-66.62	*
PCTASIAN					73.05	
PCTGEN1					-92.03	
PCTGEN2					-19.60	
PCTG1B					110.26	
PCTG2B					19.50	
PCTG1H					195.95	
PCTG2H					64.93	
PCTG1A					238.34	
PCTG2A					-167.31	

* p≤ .05, ** p≤ .01, *** p≤ .001

Unconditional Model (One-Way ANOVA)

As a primary step of hierarchical linear modeling (HLM), One-Way ANOVA (unconditional, random effect analysis of variance) was conducted to explore within-school and between-school effects on math achievement. This analysis enables us to compute the estimated variance in the dependent variables that is within schools compared to the amount of the variance that is between schools. The equation used for this analysis is "$\rho = \tau 00/ (\tau 00 + \sigma 2)$." As we can see from Table 4.3, the overall mean plausible value math score is 508.14 with a standard error of 4.35 for TIMSS 2003. The table also contains the within-school ($\sigma 2$=1179.26) and the between-school (τ=3850.72) variances. From the equation above, I can compute the proportion of variance (=.234) in math achievement for TIMSS 2003. As calculated, about 23% of the variance in math achievement is between schools. In TIMSS 2007, with the value of $\sigma 2$=1724.75 and τ=3850.72, I can compute the estimated variance of .320 for between-school differences in math achievement.

TIMSS 2003: Student-Level (Within-School) Analysis

Consistent with the OLS regression models, the same control variables and dummy variables for missing data as well as the key student-level variables, immigrant generation status and race, were included. Table 4.3 presents student-level analysis results with five plausible value mathematics scores of TIMSS 2003 as the outcome variables. Student-level HLM analysis helps to determine if the effects of immigrant generation status and race on math achievement varies within schools. All of the student-level predictors were centered on the grand means, except for Hispanic variables which were centered on the group-mean. As seen in table 4.3, once school-level variables were

included, student-level coefficients and significance were changed differently from the OSL regression results in Appendix 3.

In table 4.3, the first column presents the list of variables and the second column displays a simple description about the variables. The third column presents the first step of HLM analysis for TIMSS 2003, solely including student-level background and race variables. The student-level model indicates that the average math achievement across schools is 00=500.63($p \leq .001$). Throughout the three columns racial effects are substantive for Black, (ß= -42.32, $p \leq .001$) and Hispanic (ß= -24.62, $p \leq .01$) students while Asian effects disappear differently from the OSL regressions. Immigrant generation effects also disappear once school-level effects were included. Not only the variances from the first and second generation variables but also those from the compound variables for race and immigrant generation status are not substantive in the student-level of HLM, for students' background variables, gender (ß= 5.14, $p \leq .05$) and parents' education level (ß= 5.60, $p \leq .001$) consistently report statistical significance over the models while English usage at home does not display any significance.

In short, within a school, being Black or Hispanic has a substantially negative effect on math achievement. However, being an immigrant, either first or second generation, does not make any difference on math achievement within the same school.

TIMSS 2003: School-Level (Between-School) Analysis

For school-level analyses, I created twelve separate variables from aggregating student-level variables by school ID. Those variables give a glimpse of the composition of the participating schools. All school-level variables were grand-centered. Column III

of table 4.3 represents the effects of these variables including the PUBPRV (public/private school) variables on math achievement. Between public schools and private schools, students attending private schools tend to excel in math more frequently than those in public schools (ß= 12.47, p≤ .05).

The school-level analysis on TIMSS 2003 shows that a high percentage of black students in school is significantly related to negative math achievement (ß= -38.20, p≤ .001). This means that students in a school which is Black-dominant tend to underperform than their counterparts in averagely white-dominant schools. While the percentage of Hispanic students present a negative effect (ß= -20.26) and that of Asian students show a positive effect (ß= 87.10), both of them are not statistically significant. This result can be interpreted that being in a Hispanic-dominant or Asian-dominant school does not make any difference on math achievement.

Schools which have a high percentage of first generation immigrants in its student composition are inclined to outperform in math (ß= 230.63, p≤ .001). However, the percentage of second generation immigrants does not have any substantive effect on math achievement. The interaction variables, all first-generation-combination variables (PCTG1B, PCTG1H, and PCTG1A) report as substantive (ß= -542.02, p≤ .05, ß= -275.58, p≤ .01, ß= -468.58, p≤ .01) whereas none of the second-generation-combination variables (PCTG2B, PCTG2H, and PCTG2A) show statistical significance. This result can be interpreted that there are some schools where more first generation immigrants, regardless of race, are concentrated and those schools possibly show low-performance. This is consistent with the literature demonstrating that first-generation immigrants tend to be congregated in poorly-resourced, minority-predominant schools (Geroges & Abrahamse, 1996; Abedi, 2004) and that those schools tend to show low performance in

state or national academic assessment. According to this HLM result, math achievement of second generation immigrants, regardless of race, does not vary between schools.

TIMSS 2007: Student-Level (Within-School) Analysis

The same variables and analysis procedure were adopted for the TIMSS 2007 data. Table 4.4 presents the student-level result of HLM analysis for TIMSS 2007. In table 4.4, gender effect disappears in math achievement. Throughout the three columns, boys still tend to outperform girls (ß= 3.51), but the variance is not statistically significant. Parental education level is still positively related to math achievement (ß= 11.49, p≤ 0.001). Within a school, students whose parents are more educated are inclined to do better in math than their counterparts whose parents are less educated.

In table 9, throughout all three analyses, being Black or Hispanic within a school still affects math achievement negatively (ß= -45.15 and ß= -27.56, p≤ 0.001). In addition, no statistically significant difference was noted in math achievement for Asian students in comparison with their white counterparts. In line with TIMSS 2003, generation variables generally do not result in any variance. Although second generation in column II shows a positive effect (ß= 10.29, p≤ 0.01), that disappears once other interaction variables are included in the model. In short, even after four years, being Black or Hispanic still has a substantively negative effect on math achievement, while being Asian or immigrant does not result in any difference.

TIMSS 2007: School-Level (Between-School) Analysis

The school-level result of TIMSS 2007 shown in table 4.4 reports the consistently positive effects of parental education on math achievement (ß= 39.23, p≤ 0.001).

The percentage of Black students also shows a substantively negative effect on math achievement (ß= -50.22, p≤ 0.001). As shown in the TIMSS 2003 results, the more Black students attend a school, the lower the average math achievement of the school tends to be. Although there was no "Hispanic effect" in TIMSS 2003, the coefficient for the percentage of Hispanic students in TIMSS 2007 is -66.62, with a moderate significance level (p≤0 .05). Students in the schools where more Hispanic students are concentrated are likely to underperform their "average American" counterparts who attend schools with a predominantly white student body.

Table 4.4 presents no significance in other school-level variables. The effect of "first generation" immigration at school level disappears in TIMSS 2007.

Estimated Mathematic Achievement

From the OLS regressions and HLM results, I calculated the predicted achievement levels for different immigrant generation and race groups of students. From this estimation, one can comprehend how the students' math achievement has been changed between 2003 and 2007. While the OLS regression estimates provide mean math achievement across schools, the HLM estimates offer math achievement of either within or between school-levels. Contrary to the OLS regressions, not all the HLM results are statistically significant. Consequently, the estimated math achievements of Black and Hispanic students at within or between school-levels were computed

Table 4.5

Predicted Math Achievement Levels for Different Generation & Race Groups (OLS)

Variables		2003	2007
Race	Generation Status	Intercept = 445.98	Intercept = 441.90
Black	1st generation	346.29	290.92
	2nd generation	393.99	367.77
Hispanic	1st generation	374.18	421.51
	2nd generation	398.71	441.47
Asian	1st generation	448.01	419.20
	2nd generation	461.92	459.37

Note: The intercept and coefficients of the OLS regressions were weighted by TOTGWT.

Table 4.5 presents the predicted math achievement scores from the OLS regression results. To compute the predicted math achievement levels, I added the coefficients of the needed variables to the intercept (as in Tables 4.3 and 4.4). For example, to get the predicted math score of a first generation Black student (346.29) in TIMSS 2003, I added -76.04 (BALCK), -13.05 (GEN1), and -10.60 (GEN1*BLACK) to the intercept (445.98). Likewise, other estimates were computed. As seen in Table 4.5, first generation Black students underperform compared to all immigrant generations and racial classes (346.29 in 2003 and 290.92 in 2007), while second generation Asian students perform higher than most (461.92 in 2003 and 459.37 in 2007). In Table 4.5, regardless of race, second generation immigrants tend to outperform their first generation counterparts. Compared with the estimates of TIMSS 2003, estimated math achievement scores of Hispanic students tend to increase in both generations. However, both Black and Asian immigrant students in TIMSS 2007, irrespective of immigrant generation status, show lower achievement levels compared with their counterparts in TIMSS 2003.

Table 4.6 presents the school-level math performance levels of Black and Hispanic students. As no Asian variable was reported to be statistically significant, the estimate was done for Black and Hispanic students. In addition, as no generation variable was substantive, generation effect was excluded from the calculation. To compute the predicted mean math achievement for Black and Hispanic students, I used the intercepts and coefficients in Tables 4.3 and 4.4. To calculate mean math achievement within a school, I added student-level coefficients (BLACK=-40.14, for example, in TIMSS 2003) to the intercept (500.63). For between-school estimates, I multiplied the school-level coefficients (between-school effect) with the mean of BLACK (.13 for both TIMSS 2003 and 2007) and HISPANIC (0.16 for TIMSS 2003 and 0.24 for TIMSS 2007) for school-level variables that indicate the mean percentage of Black or Hispanic students per school.

As seen in Table 4.6, within a given school Hispanic students tend to underperform compared to their white counterparts (495.66 compared to 500.63), but outperform Black students (460.69) in TIMSS 2003. Hispanic students consistently do better in math after four years, per 2007 data. Between schools, those with a higher Hispanic student population (497.39) tended to outperform schools with more Black students (495.29) in TIMSS 2003. However, in 2007, schools with more Black students tended to outperform schools with more Hispanic students.

Table 4.6

School-level Math Achievement Levels for Black and Hispanic Students (HLM)

Variables		2003	2007
Race	School-level	Intercept = 500.63	Intercept = 502.80
Black	Within school	460.49	462.27
	Between school	495.66	496.27
Hispanic	Within school	473.29	486.81
	Between school	497.39	470.62

CHAPTER V

DISCUSSION AND CONCLUSION

In this study, I examine immigrant students' academic achievements. I paid close attention to the achievement gaps among different student groups and the effect of immigrant generation and race on these gaps. As already demonstrated in many previous studies (Min, 1997; Portes & Rumbaut, 2001; Rong & Peissle, 2009), immigrant generation and race are two strong, influential factors affecting the academic achievements of immigrant students. Therefore I carefully recoded the variables for immigrant generation status and race to probe how each factor, and the compounding effect of the two factors, affects the achievement gaps.

As shown in Table 2.1, I classified six different nativity cases into three immigrant statuses: first generation, second generation, and third/native-born generation. I also created dummy variables for each racial category: white, black, Hispanic, Asian, Native Indian, other race (in TIMSS 2007 only), Pacific Islander, and unknown race. With careful consideration of these two factors, I examined whether variances in math achievement exist among different immigrant generations and race groups and how the patterns of disparity in math achievement differ among them. For the controls I used gender, parents' highest education level, and frequent use of English at home.

I used the U.S. Trend in Mathematics and Science Study (TIMSS) 2003 and 2007 data to investigate the research questions. I utilized both stepwise Ordinary Least Square (OLS) regressions and Hierarchical Linear Modeling (HLM) for the analysis tools. The OLS regressions provided an opportunity to understand how various factors are related

to the differences in immigrant students' math achievement across the schools. Contrarily, the HLM enabled me to look at the nested effects of school-level immigrant generation status and race on math achievement. Since the TIMSS data was collected in multilevel, it was necessary to analyze the data considering school-level effects on immigrant students' math achievement. In addition, estimated math scores for each year were computed so that comparison could be made on how the achievement gaps have changed over time.

This chapter summarizes the findings of this study and elaborates the main findings based on the literature review in chapter 2. Theoretical and political implications of this study will then be considered. The last part will present some suggestions for future study.

Summary and Discussion of Findings

This part summarizes the findings of this study and deliberates them in comparison with the literature. The first research question of this study is, 'Are there gaps in the educational achievement of immigrant students from different racial groups compared with their native-born White counterparts?' As seen in chapter 2, many researchers showed achievement gaps, which exist between non-White immigrant students and their Native-born White counterparts (Portes & Zhou, 1993; Kao & Tienda, 1995; Zhou, 1997; Portes & Rumbaut, 2001; Rong & Preisssle, 2009). Schwartz & Stiefel (2006) even argued "nativity" solely is highly related to academic achievement.

The OLS regression results showed that there is a disparity between non-white immigrant students and their native-born white counterparts, neglecting schools they are

enrolled in. According to the OSL results, Asian immigrant students tend to outperform not only their native-born White counterparts but also other immigrant ethnic groups. Although the coefficients of Asian immigrant students are positively higher in both the OLS regressions and the HLM in general, the values are not substantive in the HLM results. This can be interpreted as academic performance of Asian immigrants and native-born White Americans, which becomes compatible with each other within a school. Additionally, according to the school-levels result of the HLM, a school which has more first-generation Asian immigrants tends to underperform in comparison to an "all-White" school. In other words, the so-called "Asian privilege" which means that Asian immigrants in American schools are good in mathematics (Portes & Min; 1993; Choi et al.; 2001; Portes & Rumbaut, 2005) may have disappeared recently.

Black immigrant students, however, show wide achievement gaps when compared with their native-born White counterparts. The literature demonstrates historical differences in academic achievement between White and Black students (Gibson, 1988; Waters, 1996; Portes & Rumbaut, 2001). Although first-generation Black immigrants from West Indian Islands tend to outperform native-born African Americans (Model, 2008; Healey, 2008), they still underachieve the native-born White students. Moreover, as generations pass, Black immigrant students are likely to assimilate into the African American group and eventually become floundering into the reality (Healey, 2008; Stepick & Stepick, 2009).

The OLS regression results present just "being Black" as having a significantly negative effect on math performance, regardless of their place of birth, in both 2003 and 2007 assessments. However, unlike the literature, the results of this study show positive effects to being second-generation Black immigrant, while the effect of being first-generation shows the opposite. The estimated math achievement shown in chapter 4 also

displays that first-generation Black immigrants are likely to underachieve all other immigrant race groups. The HLM results were similar to the OLS regressions. Within a school, Black students, particularly first-generation, tend to underperform their White-counterparts. Between schools, schools where more Black students attend are inclined to show lower math achievement than those where no colored students attend. Findings suggest that the historically wide disparity in academic achievement between Black and White students still remains even in the era of accountability.

Hispanic immigrants also tend to underperform their native-born White counterparts despite their rapid growth in population (Bouchey & Harter, 2005; Fry, 2007; Rong & Preissle, 2009). As many Hispanic students fall into either first or second generation immigrant groups, they tend to lack certain social and economic resources needed for a better education (Johnson et al., 2001; Rong & Preissle, 2009). Moreover, many of them are classified as Limited English Proficiency (LEP) students, which often hinder those Hispanic students' understanding of the test content, as well as the school curriculum. Therefore, compared to white American students, the average Hispanic student's math achievement is generally lower.

With similarities to black students, the results from the OLS regressions and HLM indicate that wide achievement gaps between the native-born whites and Hispanic immigrants still remain over time. Although overall math scores have increased, they still fall below the average of their white counterparts. "Being Hispanic" has a negative effect on math achievement not only within a school, but also between schools. However, in 2007, immigrant effect disappeared when the school-level effect was included.

The second research question was "are there gaps in educational achievement among different generations of immigrant students within the same racial group?" Many

studies that present students of different immigrant generation show different academic performances (Portes & Min; 1993; Kao & Tienda, 1995; Min, 1997a; Min,1997b; Brown & Bean, 2006; Rong & Preissle. 2009). Different assimilation perspectives explain the relation between immigrant generation status and their academic performance. Classic assimilation theory argues academic performance becomes better and better as generations pass. However, oppositional assimilation theory claims that immigrants, particularly non-white immigrants, tend to blend into the lower social classes instead of achieving upward mobility. This phenomenon happens once non-white immigrants face the metaphorical "glass ceiling" in society and give up struggling for higher social status.

The segmented assimilation theory supports diversified assimilation patterns depending upon various factors, such as social context of entrance, race/ethnicity, and immigrant generation. The segmented assimilation emphasizes both the immigrant generation status and ethnic/race background of the immigrants. In fact, the combination effect of these two factors strongly affects the academic achievement of immigrant students. For example, even in the same Hispanic groups, studies show that many Mexican and Western Indian immigrants tend to show downward assimilation patterns. On the contrary, Cuban immigrants are likely to show classic assimilation patterns with assistance from their strong Cuban community in Florida. Hence, Cuban students even tend to outperform their white-counterparts. In addition, many Asian immigrants are generally expected to show classic assimilation patterns in that their academic performance improves as time goes by. However, although there is a tendency that the second-generation Asian immigrants tend to outdo their first-generation counterparts, the third-plus Asian immigrants are likely to blend well into the American society. As a

consequence, their academic performance declines nearly to the average of the native-born white.

Overall, the findings of this study do not correspond solely to either the classic or the oppositional assimilation theories. Instead, they are inclined to coincide with the segmented assimilation theory. The second-generation immigrants are likely to outdo the first-generation according to the OLS regression results of this study. However, the second-generation immigrants still tend to underachieve than the native-born Americans. When combined with race factor, first-generation black students are more likely to underachieve than any other immigrant groups, while second-second generation Asian students tend to outdo even their native-born white counterparts. This result is in line with the previous research.

However, the HLM presents somewhat different outcomes. Both within a school and between schools, first-generation students tend to underperform than their second-plus counterparts in 2003. In addition, the achievement outcomes of the second-generation immigrants show no statistical significance in 2003. However, in 2007, none of the achievement gaps between the first generation and the native-born or the second generation and the native-born is substantive. In other words, in 2007 the statistical results indicate that there is no significant difference between different generations, both within a school and between schools.

In summary, among the assimilation theories, the segmented assimilation theory has relevance to my study, because the theory assumes different assimilation patterns of the immigrant youth. This study suggests how immigrant generation and race are connected with each other and can affect the educational achievements of the immigrants.

The final research question was “If such gaps exist, were these closed over time from 2003 to 2007?” Lee (2002) studied the NAEP and summarized the trend in achievement gaps over the period of 30 years. According to him, although overall achievement scores have increased, achievement gaps between black or Hispanic immigrants and their native-born white counterparts either “stabilized” or “widened.” However, according to the relatively recent report from the National Center for Educational Statistics (Vanneman et al., 2009), although white students still gain higher math scores, the gaps between black and white students have narrowed. According to another recent study (Reardon & Galindo, 2008) about the achievement gap between Hispanic and white students, the gaps have slightly narrowed during the early school years and then stay “stable." They also argue that within the Hispanic immigrants, the second generation is likely to outperform the first generation over time.

To examine how achievement gaps have changed over time, I computed the estimated math scores for each immigrant race group by using the intercepts and coefficients of the OLS regressions and the HLM analysis. Although the two analyses present different results in detail, second generation students tend to outperform the first generation students both in 2003 and 2007.

The OLS regression estimates display consistent disparities between black immigrants and their native-born white counterparts. In both years, Black immigrant students have the lowest achievement scores among all immigrant race groups. Moreover, their math scores go even lower in 2007 regardless of generation status. This means the achievement gap between Black immigrants and the native-born White Americans has widened over time. On the contrary, math achievement of Hispanic immigrants has increased over the years. In addition, although Hispanic immigrant students tend to have lower achievement level in comparison to their native-born White counterparts, the

second-generations in 2007 seem to almost catch up with their White counterparts. On the other hand, Asian immigrants surpass the Native-born White in 2003. However, in the year 2007, first-generation Asians show lower achievement than their Native-born White counterparts.

The computed math scores from the HLM showed different results in comparison with the OLS estimates. Achievement gaps between Black immigrants and Native-born White students seldom change. Although the average math score has increased, the gap did not increase or decrease. Hispanic students on the other hand, show different patterns. First-generation Hispanic students have an increase score in math, which narrowed the achievement gap between them and the native-born White students. On the contrary, the second-generation Hispanic immigrants gain lower math achievement, which broadened the achievement gap between them and their native-born White counterparts. Although the two analyses provide different estimates, they accord with the literature to some extent. As the literature argues, disparities in math achievement between the native-born White students and the immigrant students exist over time. Moreover, the gaps vary according to the immigrant generation and racial status of the immigrants. The OLS regression estimates for Black immigrants concur with the oppositional assimilation theory which states that as generation passes, Black immigrants tend to integrate into the lower-class African American and thus, the second-generation Black immigrants consequently show poor academic performance.

On the contrary, the HLM estimates coincide with the recent research outcomes that achievement gaps between black and white students have faltered. For Hispanic immigrants, the estimates of the OLS regressions and the HLM analyses can be interpreted differently. The OLS regression results are agreeable with the classic assimilation theory, while the HLM results correspond to the oppositional assimilation

theory. For the outcomes of the Asian immigrants, the OLS regression results are in accordance with the classic assimilation theory showing evidence of "Asian privilege." On the whole, the academic performance of immigrant students tend to be versatile, depending upon the different immigrant generation and their racial feature, which can be interpreted as having a thread of connection with the segmented assimilation theory.

In summary, the main findings of my dissertation are as follows. Firstly, immigrants are generally likely to underperform compared to their native-born white counterparts. Secondly, achievement gaps among different immigrant generation groups of a same race are likely to be diverse. Thirdly, the pattern of the academic disparities between black or Hispanic immigrants and their native-born white counterparts tend to remain fairly stable over time.

Implications for Policy and Practice

Under the era of NCLB, people expect to see the achievement gaps between different student groups narrow over time. This study illuminates the currently controversial issue of disparities in education. This study particularly focuses on the achievement gaps between immigrant students and native-born white Americans. In addition, this study goes one step further than previous research by classifying the immigrant groups by their immigrant generation and race.

The results of this study suggest that everyone needs to be aware of the substantive achievement gaps among different immigrant student groups, whether they are parents, teachers or policymakers. Upon realizing the gaps, parents can help their children raise their academic aspiration so as to make their children become

academically motivated. Teachers at school also play a significant role in helping immigrant students get involved more in academic activities at school. Along with support from each school and school district, teachers can develop the appropriate curriculum for the immigrant students. Teachers also can stress the importance of education to their immigrant students for higher education and better life in consequence. Schools also can contribute to enhance the educational outcome of immigrant students by educating immigrant parents and providing the immigrant students with the bilingual or ESL programs. Those language programs, in combination with other subject areas, may improve the educational attainment of immigrant students.

Policymakers, on the other hand, can help to narrow achievement gaps between immigrant students and their native-born counterparts in a macro perspective. From the results of this study, we realize different immigrant groups need different interventions. For instance, black immigrants tend to struggle in schools. Many of these black immigrants are from the West Indian Islands and are relatively fluent in English even though they are the first-generation. For them, financial support and having a role-model for success are needed the most. On the contrary, more than half of the Hispanic and Asian first- and second-generation immigrants are LEP students. Thus, to improve their academic performance, bilingual programs or other language-related support from the school and society are necessary. Likewise, policymakers should examine this issue from various angles when formulating a law.

Theoretically speaking, this study contributes to the fields of immigrant education and educational inequalities. Many researchers have tried to examine the achievement gaps by focusing on certain racial groups of immigrants such as Hispanic immigrants or Asian immigrants. However, this study investigates its research problems in a broader yet more elaborated way by including all immigrant groups and taking their different immigrant

generation and race into consideration. In addition, by comparing two different years under the era of NCLB, this study enables us to compare how achievement gaps have changed over time.

Limitation of the Study and Recommendations for Future Study

This study aims to investigate the diverse patterns of attainment gaps between different immigrant groups and the native-born whites. In the research process, I faced some limitations and, accordingly, several possible suggestions for future research. Firstly, for the school-level analysis, I included the variables for race representation as well as a variable for public/private schools. In a future study, more school factors should be included in order to draw a holistic representation of the school-level effects on immigrant students' academic achievement. Some possible school-level variables I can suggest are school resources, percentage of students provided with free-lunches, and language programs. Secondly, although TIMSS data were collected in a multilevel, I did not include the classroom-level effects. As adolescent students are more likely to be influenced by their peers and their school experiences, particularly in-class experiences, it is necessary to take the class-room level effect on immigrant students' achievement into consideration.

Another recommendation for future research is including some cultural/ethnic backgrounds in the analysis. The segmented assimilation theory emphasizes cultural assets of immigrant students in determining the success or failure of their academic performance. For instance, Chinese or Korean Americans tend to outperform in school thanks to the strong influence of their cultures. In Florida, the second-generation Haitians

are inclined to underperform in school, due to lack of communal/cultural support, compared to the Cuban immigrants. Likewise, for a more accurate explanation of the academic experiences of immigrant students, cultural backgrounds should be included.

Although the TIMSS assessment began in 1995 and continued every four years, I used only the 2003 and 2007 data. In the 1995 and the 1999 data, the race variables are restricted to the license holders for NCES data. Due to the limited access to the data, I could only compare the math scores of the two sets of data. Therefore, if any researcher has the license to use the 1995 and the 1999 TIMSS data, I suggest looking at the achievement gaps in a longitudinal perspective so that we can examine how the achievement gaps have changed in 16 years. As an alternative, one can use TIMSS 2011 data, which will be released in 2012, for the longitudinal analysis.

The final extension of this study would be to include policy-level variables. People want to know if NCLB is successful or not. To examine its effectiveness, we need to know how the policy actually contributes to the achievement gaps of different students. The inclusion of a national-level policy-related variable will allow us to distinguish the effect of the policy and exclude other factors.

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APPENDIX A

Appendix A.1 IDB Analyzer Regression Results for TIMSS 2003

	I			II		
	Coeff.	Standard Error	t-test	Coeff.	Standard Error	t-test
Intercept	432.60	8.81		442.49	8.43	
Gender	4.96	1.83	2.71*	5.51	1.81	3.05*
Parent's Education Level	11.88	1.30	9.14*	12.21	1.25	9.73*
English Usage at Home	9.48	1.93	4.91*	6.58	1.84	3.57*
Black	-74.93	5.23	-14.32*	-73.99	5.03	-14.70*
Hispanic	-48.00	4.90	-9.80*	-46.87	5.06	-9.25*
Asian	16.63	6.70	2.48*	19.95	6.90	2.89*
Other	-43.95	7.70	-5.71*	-41.80	8.50	-4.92*
Unknown Race	-26.60	10.60	-2.51*	-23.74	9.95	-2.39*
First Generation				-20.57	6.04	-3.41*
Second Generation				2.77	4.11	.67
Unknown Generation				-39.61	13.94	-2.84*
R-Square			.19			.20`

JRR Repeated Replication was used, Weighted by TOTWGT, PV Math Score

Appendix B OLS Regression Result with Five Plausible Value Mathematic Scores

Table B.1 OLS Regression Results with Plausible Value Mathematic Score of TIMSS 2003

	PV I		PV II		PV III		PV VI		PV V	
	Coeff.	Ɓ	Coeff.	Ɓ	Coeff.	Ɓ	Coeff.	Ɓ	Coeff.	Ɓ
Intercept	453.44		452.01		454.46		448.75		449.31	
Gender	5.77***	.04	5.78***	.04	5.83***	.04	5.69***	.04	6.10***	.04
Parent's Education Level	4.57***	.07	4.79***	.04	4.15***	.03	5.39***	.04	4.57***	.04
English Usage at Home	11.39***	.16	11.67***	.16	11.89***	.17	11.82***	.17	12.29***	.18
Black	-76.11***	-.33	-77.79***	-.33	-77.16***	-.32	-76.35***	-.32	-73.49***	-.31
Hispanic	-45.03***	-.21	-45.51***	-.21	-50.22***	-.23	-47.84***	-.22	-46.22***	-.21
Asian	23.30***	.06	32.45***	.08	24.75***	.060	20.47***	.05	19.46***	.05
Other Race	-45.37***	-.07	-43.70***	-.07	-44.42***	-.07	-42.82***	-.07	-42.45***	-.07
Unknown Race	-30.01***	-.04	-30.00***	-.04	-31.23***	-.04	-33.63***	-.04	-29.81***	-.04
First Generation	-15.38***	-.05	-18.01***	-.06	-11.97***	-.04	-11.90***	-.04	-14.77***	-.05
Second Generation	-.354*	-.00	1.22	.01	-.08*	.00	.75	.00	.61*	.00
Unknown Generation	-36.40***	-.06	-33.79***	-.06	-34.79***	-.06	-34.17***	-.06	-35.39***	-.06

1st Generation * Black	-5.57***	-.01	-8.74***	-.01	-9.54***	-.01	.07***	.00	-13.08***	-.01
2nd Generation * Black	26.25***	.04	29.08***	.04	30.58***	.04	30.70***	.04	26.73***	.04
1st Generation * Hispanic	-17.12***	-.04	-12.59***	-.03	-20.77***	-.05	-14.98***	-.03	-16.94***	-.04
2nd Generation *Hispanic	-6.67***	-.02	-8.69***	-.03	-2.07***	-.01	-3.09***	-.01	-6.50***	-.02
1st Generation * Asian	-3.251***	-.01	-6.21***	-.01	-6.47***	-.01	-1.00***	.00	2.45***	.00
2ndGeneration * Asian	-4.52***	-.01	-8.61***	-.02	-4.59***	-.01	.13***	.00	1.23	.00
	.20		.21		.21		.20		.20	

Table B.1 OLS Regression Results with Plausible Value Mathematic Score of TIMSS 2003

	PV I		PV II		PV III		PV VI		PV V	
	Coeff.	Ƀ	Coeff.	Ƀ	Coeff.	Ƀ	Coeff.	Ƀ	Coeff.	Ƀ
Intercept	441.90		441.68		437.27		442.91		438.41	
Gender	1.36***	.01	.60***	.00	1.65***	.01	1.33***	.01	1.84***	.01
Parent's Education Level	2.58**	.02	3.30***	.03	3.96***	.03	3.02***	.03	4.21**	.04
English Usage at Home	18.70***	.27	18.46***	.26	18.44***	.26	18.07***	.26	17.99***	.26
Black	-73.26***	-.32	-72.54***	-.31	-71.84***	-.31	-74.16***	-.32	-71.66***	-.31
Hispanic	-47.52***	-.27	-47.93***	-.27	-47.49***	-.26	-48.97***	-.27	-46.94***	-.26
Asian	16.13*	.04	18.94*	.04	20.55*	.05	20.48*	.05	20.13*	.05
Other Race	-42.03***	-.06	-42.51***	-.06	-36.62***	-.05	-52.20***	-.08	-37.77***	-.06
Unknown Race	-19.55***	-.02	-23.03***	-.03	-23.21***	-.03	-20.31***	-.02	-19.57***	-.02
First Generation	-26.39***	-.07	-24.45***	-.06	-23.53**	-.06	-26.68***	-.07	-23.68*	-.06
Second Generation	-37.56***	-.03	-44.60***	-.04	-36.28	-.03	-38.56***	-.03	-45.89***	-.04
Unknown Generation	-5.85***	-.02	-3.62***	-.02	-4.29***	-.02	-6.70***	-.02	-3.28***	-.01

1st Generation * Black	5.19***	.03	5.14***	.03	5.09***	.03	5.14***	.03	3.62***	.02
2nd Generation * Black	-40.16***	-.06	-43.20***	-.07	-39.81***	-.06	-38.59***	-.06	-35.49***	-.06
1st Generation * Hispanic	4.98***	.01	8.53***	.01	6.33***	.01	9.20***	.01	-.48***	.00
2nd Generation *Hispanic	17.12***	.02	17.82***	.03	12.16***	.02	19.80***	.03	19.29***	.03
1st Generation * Asian	5.42***	.02	.12***	.00	.38***	.00	4.72***	.01	.90***	.00
2ndGeneration * Asian	14.86**	.06	15.17*	.06	15.42**	.06	14.98**	.06	18.08*	.07
	.25		.24		.23		.24		.23	

APPENDIX C Stepwise OLS Regression Results

Table C.1 Effect of Generation Status and Race on Academic Achievement (OLS regression result, TIMSS 2003)

	I		II		III		IV	
Variable	Coeff.	*Beta*	Coeff.	*Beta*	Coeff.	*Beta*	Coeff.	*Beta*
Intercept	509.90		401.89		443.98		445.98	
GEN1	-45.16*	-.14	-27.34*	-.08	-21.25*	-.06	-13.05*	-.04
GEN2	-16.44*	-.07	-6.99*	-.03	.85*	.00	-.30	-.00
NOGEN	-48.82*	-.09	-53.62*	-.09	-41.99*	-.07	-42.61*	-.07
GENDER			6.05*	.04	5.70*	.04	5.82*	.04
HOMELANG			11.59*	.09	6.50*	.05	6.01*	.05
PARENTED			13.52*	.19	11.74*	.17	11.67*	.17
BLACK					-73.91*	-.32	-76.04*	-.33
HISPANIC					-44.71*	-.20	-39.89*	-.18
ASIAN					18.71*	.04	21.87*	.05
OTHER					-41.77*	-.07	-42.88*	-.07
NORACE					-23.70*	-.03	-24.09*	-.03
G1B							-10.60*	-.01
G2B							24.35*	.04
G1H							-18.86*	-.04
G2H							-7.08*	-.02
G1A							-6.79	-.01
G2A							-5.63	-.01
Adjusted R-Square	.03		.07		.20		.20	

a. Dependent variable: TIMSS 2003 1st Plausible Value Mathematic Score

b. *statistically significant at $p \leq .001$ level

c. Weighted with TOTGWT (total student weight)

Table C.2 Effect of Generation Status and Race on Academic Achievement (OLS regression result, TIMSS 2007)

	I		**II**		**III**		**IV**	
Variable	Coeff.	*Beta*	Coeff.	*Beta*	Coeff.	*Beta*	Coeff.	*Beta*
Intercept	514.59		393.25		443.25		440.78	
GEN1	-33.90*	-.12	-11.04*	-.04	-1.76*	-.01	-5.27*	-.02
GEN2	-15.97*	-.08	4.33*	.02	13.89*	.07	6.24*	.03
NOGEN	-44.21*	-.08	-53.05*	-.08	-40.69*	-.07	-39.93*	-.06
GENDER			2.35*	.02	1.27*	.01	1.28*	.01
HOMELANG			6.91*	.06	2.40*	.02	2.65*	.02
PARENTED			21.94*	.32	18.45*	.27	18.71*	.27
BLACK					-71.93*	-.31	-73.17*	-.32
HISPANIC					-44.24*	-.25	-47.42*	-.27
ASIAN					17.82*	.04	16.15*	.04
OTHER					-30.00*	-.09	-28.80*	-.09
NORACE					-40.79*	-.04	-37.81*	-.03
G1B							.00*	.01
G2B							4.39*	.01
G1H							16.01*	.02
G2H							4.97*	.01
G1A							13.90*	.06
G2A							22.99*	.03
Adjusted R-Square	.02		.13		.24		.24	

a. Dependent variable: TIMSS 2003 1st Plausible Value Mathematic Score

b. *statistically significant at $p \leq .001$ level

c. Weighted with TOTGWT (total student weight)

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