

GRADUATE SCHOOL EXPERIENCES AND POST-GRADUATION PLANS OF
INTERNATIONAL SCIENCE AND ENGINEERING DOCTORAL
STUDENTS AT A PUBLIC UNIVERSITY

by

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Abstract

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This quantitative study examines the graduate school experiences of international science and engineering doctoral students at a public University and aims at understanding to what extent graduate school experience influences their post-graduation plans. It highlights problems international doctoral students go through such as adapting to a new culture, struggling with English language difficulties, experiencing cultural, social, and academic adjustment problems.

Recommendations include development of institutional initiatives to provide socio-cultural and academic support and also changes in immigration policies that can sustain the retention of more international doctoral students in science and engineering fields upon the completion of their studies. Finally, implications of these findings and recommendations for future studies, policy and practice are discussed.

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Chapter 1

Introduction

Since World War II, the United States (U.S.) has experienced a steadily growing inflow of international student enrollment at institutions of higher education. The Institute of International Education (IIE) reported that the number of international students in the U.S. increased by 6% compared to the previous year to a record high of 764,495 students (IIE, 2012). According to several studies, this number will rise to 8 million by the year 2025 (Altbach & Bassett, 2004; Eustace, 2007; Fischer, 2009).

Particularly, American universities have experienced a proliferation of international graduate students on their campuses. It is estimated that the number of international graduate students currently attending universities in the U.S. reached 300,430 representing 39% of all international students in the country (IIE, 2012). Out of this number, about 180,258 or 60% were enrolled in graduate programs in science and engineering (S&E) fields.

A previous report from the National Science Foundation (NSF) indicated that in 2005-2006, foreign-born students accounted for 36.2% of all the doctorates in the sciences, and approximately 63.6 % of doctorate degrees in engineering (NSF, 2009). This same report pointed out that international students continue to receive 57% of doctorates awarded to students in engineering, 54 % of doctorates in computer science, and 51 % of doctorates in physics. This trend has continued unabated.

There are clear efforts to recruit talented international students in science and engineering (S&E), but many argue that the United States should also retain S&E graduates even more now in the light of increased global competition for the best scientists and engineers (Wulf, 2005). Research has shown that the U.S. depends heavily on international students to compensate for the shortage of American-born

students willing to enroll into the science, technology, engineering, and mathematics (STEM) programs in U.S. institutions of higher learning. Additionally, many industry and research related STEM jobs are performed by foreign nationals on temporary visa programs, and many future jobs will require knowledge and skills for which the U.S. experiences a labor force shortage. While interest in the STEM fields has dwindled over the years in terms of degrees earned by U.S. students, STEM careers and jobs, both in the U.S. and abroad continue to grow.

The U.S. Department of Labor (DOL) projects that by 2018, over 15 of the 30 fastest growing occupations will require some amount of STEM education (U.S. Bureau of Labor Statistics, 2009). As a long-term goal, it is necessary for the U.S. to find ways to encourage and prepare more U.S. born students to fill the gap that currently constrains the nation's ability to generate enough qualified and prepared workers for the STEM fields. In the meantime, the U.S. would need to create and maintain a STEM-capable workforce by recruiting, training, and retaining international students to sustain the science and engineering workforce. According to Wulf (2005), recruiting and retaining international students who are enrolled in the S&E programs, is considered to be strategic to the U.S. competitiveness and growth within the global economy.

Although international graduate students report generally high satisfaction with their academic experiences at the U.S. institutions of higher education, research has demonstrated that these students face a plethora of challenges in adjusting to the new environment and are often frustrated with their experiences outside the classroom (Curtin, Stewart, & Ostrove, 2012). A legitimate concern is how foreign students adjust to the American society, and whether they consider staying in the country and contributing to American economy upon graduation. According to Lee (2010), the increasing number of international students in the United States is not an indication that adjusting to the host

culture is not problematic for these individuals. In fact, many studies show that international students experience more challenges in college than their American peers because of their different social, academic, and cultural backgrounds (Lee, 2010; Moffett, 2006; Mori, 2000; Yeh & Inose, 2003). A great deal of the literature on international students emphasizes other factors that may influence their adjustment to the new environment regardless of their academic program (Cardona, Milian, Birnbaum & Blount, 2013; Sherry, Thomas & Wing Hong, 2009; Yeh & Inose, 2003).

Among the factors that affect ability to adjust to life in American colleges, research has identified demographic factors such as age and sex (Huntley, 1993; Lee, Park, & Kim, 2009), and culture-specific factors such as one's race/ethnicity or region of origin (Hull, 1978; Yeh & Inose, 2003). Furthermore, an obvious adjustment obstacle is individual's level of English language proficiency (Andrade, 2006; Galloway & Jenkins, 2005; Huntley, 1993; Lee, 2010; Lee, Park, & Kim, 2009; Lo, 2002; Mori, 2000; Poyrazli & Grahame, 2007; Sherry, Thomas, & Chui, 2010; Sherry, Thomas, & Wing Hong, 2009; Yeh & Inose, 2003). Studies have also shown that lack of English language proficiency may affect the academic and social adjustment of international students (Andrade, 2006; Yeh & Inose, 2003).

Addressing adjustment issues is crucial in order to reduce students' acculturative stress and help them overcome culture shock in a foreign country (Berry, 1997; Oberg, 1960; Yeh & Inose, 2003). Nevertheless, international students have good program completion rates and shorter time to earn their degrees than their U.S. peers (Cardona, Milian, Birnbaum & Blount, 2013; Curtin, Stewart, & Ostrove, 2012). Having good completion rates makes this group very attractive for higher education pursuit and a catchment target to institutions that invest significantly in the internationalization of their campuses.

Given the growing numbers of international doctoral students pursuing and earning doctoral degrees in science and engineering (S&E), and the potential benefits of retaining foreign-born scientists and engineers educated in the U.S., it is somewhat astonishing that the international graduate student population has been relatively understudied (Corley & Sabharwal, 2007; Ren & Hagedorn, 2012). Many studies clearly pointed out that existing research does not discuss international students enrolled in doctoral program (Lee & Gardner, 2010; Mehra & Bishop, 2007; Moffett, 2006). Specifically, many studies on international students' academic performance have either focused primarily on undergraduate students, or did not distinguish between undergraduate and graduate students (e.g., Abel, 2002; Light, Xu, & Mossop, 1987; Yeh & Inose, 2003). Therefore, it is imperative to conduct a study on the graduate school experiences of international doctoral students by field of study with particular focus on science and engineering.

Furthermore, despite the significant implications of international doctorates' decisions to stay versus leave the U.S. after graduation, a few studies have investigated the career trajectories and plans of doctoral students (Thune, 2009) and their successes in the labor market. There is also a paucity of research on how the students' decisions to stay in the U.S. differ by various factors such as region of origin and field of study (Saravia & Miranda, 2004). This dearth of information makes it difficult for U.S. policy makers to develop policies and programs that can successfully attract and retain the highly skilled doctoral students (Kim, Bankart, & Isdell, 2011).

Evidently, the examination of adjustment issues experienced by international students studying in the U.S. universities constitutes a valuable area of research with implications for students and the higher education institutions. The high level of participation of S&E foreign-born doctoral students in U.S. colleges and universities,

industry, laboratories, and community as a whole (Boehlert, 2001; Borjas, 2001; IIE, 2010-2011; Lee, 2008; McMurtrie, 2011; Wulf, 2005) demands increased efforts to understand this phenomenon of adjustment and to ensure that policies helping their graduate school experiences and post graduation decisions are adequate . Therefore, the current study that focuses on graduate school experiences and post graduation plans of doctoral students enrolled in the S&E programs at a public research university is expected to address a research gap with significant policy and practice implications for the national S&E workforce development.

Statement of the Problem

The United States economic growth and its leading position in the global markets depends heavily on advancements in science, technology, engineering, and mathematics (STEM) fields (Machi, McNeill, Lips, Marshall & Carafano, 2009; National Academy of Sciences, 2006). The growing demand for scientists and engineers is a worldwide phenomenon and many developed countries that cannot meet this increased demand locally, recruit international students and foreign-born highly educated workers who are likely to bring a significant contribution to the higher education system and workplaces. In an era of increased global competition for the world's best and brightest scientists and engineers, recruitment of talented international students and retention of trained STEM workforce has become an issue of national importance in the United States. However, despite the magnitude of international S&E doctoral students population, the investment that higher education institutions make in preparing them, and the potential contributions that these individuals can make to the United States, S&E doctoral students' graduate school experiences and the impact on their post graduation plans have been understudied (Jen & Hagedorn, 2012; Mori, 2000). Mori (2000) points out that "international students have always remained one of the most quiet, invisible,

underserved groups on the U.S. Campus” (p. 143). A better understanding of the experiences of S&E doctoral students at a public research institution in the United States is a first step toward developing policy to retain scientific talent.

Researcher's Viewpoint

Prior to my departure to the United States, I had a short stint at a Nigerian University where I was pursuing a Bachelor's degree. This was however very short-lived. Soon after my matriculation at my campus in Nigeria, I was awarded a full scholarship by an American University to pursue a degree in Business Administration, prompting my eventual migration to the U.S. to continue my education. Moving to the United States was exciting, especially since I have never lived in any foreign country. It was something I had dreamed about for years, and so when the opportunity struck, I could not wait to see all that the world had to offer.

In the U.S., I soon realized, however, that living in a foreign culture was more challenging in ways that I had never imagined. I learnt, albeit harshly, how to adjust to the unique academic, social and cultural challenges of living and studying in a university outside of my home country. One of the main challenges then was getting to adjust to a new culture and academic system, with all the differing expectations and priorities that come with it. A case in point: I had difficulty understanding my professors or taking class notes because I was not familiar with their way of speaking or accent. Then, everyone I encountered on campus spoke too fast, and I could hardly understand all I was thought in the class. To make matters worse, I had difficulties raising my hand to ask or ask questions in the class for fear of being misunderstood or scorned at by others.

During my first semester, I was not able to make any friends with the American students because I was shy. I also feared that they would not understand me because of my accent. This affected my overall class performance. I had hoped and prayed for a

quick fix. Having made a few low grades on my earlier assignments, I summoned courage and literally forced myself to ask for help from my classmates. To my surprise, a lot of the students I spoke with were very nice and willing to help. Encouraged by their overtures, I was able to join study groups at school and utilized other available tools at my disposal to help accelerate my adjustment to persons and academic life on the campus.

Again, as an English as a Second Language (ESL) student, I was able to get extra help from the ESL student office at my University in Edinboro. The primary purpose of the office was to help students with grammar, writing and understanding of class assignments. Although it was time consuming going to the ESL office twice a week, it was such a rewarding experience for me.

Apart from academic challenges, I soon realized I had some social and cultural hurdles on campus as well. Socially, I struggled to belong to the school community, to make friends with other students or become member of any clubs and organizations in the school. Furthermore, I was not able to fully participate in any of the out-of-class activities on campus, even when these organizations were out there for free, designed for student interaction and socialization. Often times, I kept to myself instead of trying to form relationships with anyone, mainly because of problems expressing myself in conversations. My weekends were boring; I spent most of the time studying in the library. Although overall, my academic life was being fulfilled as my academic grades picked up greatly but my recluse social life was getting the worst out of me. None of my dormitory mates ever made attempts to get to know me or even tried to be friends with me. Again, I came to realize this was not normal and that something has to change. Honestly, I did not think that other students disliked me, but I felt that they did not want to impose themselves on me to be their friends.

In summary, culturally and socially, upon coming and enrolling in an American University, I found out that everything in America to me then seemed different from what it was back home. I had to readjust my eating habits, and also learnt how people behave. My culture shock also stemmed from not knowing what to do or how to do things in a new environment, and not knowing what is appropriate or inappropriate. These cultural differences significantly hindered my motivation and adjustment and I have to make personal efforts and determination to break the ice on several fronts to fully adjust to my new environment.

Upon the completion of my Bachelor's degree, I got admitted at the same Edinboro University to pursue my Master's degree in Communication Studies. I was offered a Graduate Assistant (GA) position at the International Office. The knowledge I garnered from this position was a great eye opener that helped me later to fully overcome all the negative experiences that I had earlier on in my educational journey in America.

My position at the International office enabled me to interact with international and American students and personnel. The GA position provided me with the opportunity to participate in socially, culturally, and professionally-related activities with faculties and administrators. In my official position, I was responsible for organizing and carrying out projects related to services needed by mostly international graduate students, including but not limited to participation in International Student Organization (ISO) programs, International student week, and cultural talent show and encouraging international and non-international students to participate in the events. These are campus-wide events with huge student interactive potentials. The process of communication in these events included face-to-face interactions and a lot of telephone calls. I must mention here that carrying out my day-to-day activities at the international office was an eye-opener.

First, it gave me the opportunity to assimilate fully into the American culture because of my constant communication and interaction with diverse individuals. Being in constant contact with a lot of people allowed me to carry various conversations and share my views and thoughts with them which in turn helped me to understand their way of life. Invariably, my general outlook and worldview in life were broadened by this exposure.

Secondly, I was able to grow socially and culturally. I was able to overcome my shyness, buoyed by cultural shock, which in turn gave me the confidence to make friends and interact more with the American students. Forming a much closer relationship with the native students in turn helped me to overcome my language deficiency and mal-adjustment that comes with it. It also helped me to literally come out of my shell and I was no longer afraid to deal with some of the cultural and social issues that I was drowned in earlier on in my educational journey. Not only have I grown socially, but this opportunity extended my learning experiences beyond the classroom and enhanced my professional development.

Thirdly, my position as a GA prepared me to assist other international students: undergraduate and graduate students that I came in contact with. Based on my struggles and past experiences, I was able to get a better grasp of most of the problems international students face and was able to render my help when I was asked to do so. I used the international office as an avenue to help as many students as I could and ensured that their own educational paths are paved and not as negative as mine was.

Cumulatively, my experiences over the past several years and my triumph in scaling over most of my initial adjustment problems in the U.S. helped set the stage for my current curiosity and desire to pursue a PhD in Education. I have always had the desire to research on how best international students can learn in America and also on the myriad of factors that could prevent them from doing so. My initial interest on this type

of research was expressed during my Masters Degree program when I wrote as my thesis: "Pragmatics of Intercultural Communication: Attitudes and Adjustments of International Undergraduate Students in a University Setting".

As a doctoral student in education with diverse prior adjustment experience, I have been motivated to carry out similar but further study relating to student adjustment. My current interest is to examine the extent to which other international doctoral students shared similar social, cultural, and academic experiences in their study environment. Specifically, my interest is to see whether there are any common threads that could be shared about my previous academic, social, and cultural challenges with doctoral students in other academic discipline. As shown in the literature review, international doctoral students in science and engineering are an integral part of the U.S. economy and the American universities and colleges (Greer, 2005). More research is needed in order to understand this population of students.

Purpose of the Study

The purpose of this study is to examine the relationship between post-graduation plans and graduate school experiences of international S&E doctoral students enrolled at a Public University in Texas which will be called Richman University (RU) in this study. The study will account for the effect of field of study (i.e., science, engineering), and other individual factors such as demographic characteristics (i.e., age, sex), adjustment ability (i.e., self-reported English skills), and culture-specific characteristics (i.e., race/ethnicity as a proxy for region of origin) on students' graduate school experiences and post-graduation plans. Doctoral students' graduate school experiences will be explored across several dimensions such as academic, social and cultural. Post-graduation plans will be defined in relation to students' career and personal goals.

The researcher believes that gaining an understanding of the graduate school experiences and post- graduation plans of international doctoral students could inform higher education institutions in America to proactively formulate appropriate policies and programs that would benefit these students and in long term would contribute to recruit, train and retain talented specialist in science and engineering fields.

Research Questions

The following research questions will be addressed in this study:

- Question 1 What are the profiles of doctoral students in science or engineering? How do they vary by demographic factors (i.e., age, sex), culture-specific characteristics (i.e., race/ethnicity), and field of study (i.e., science or engineering)?
- Question 2 Do the adjustment abilities of doctoral students in science and engineering measured by their self-reported language proficiency vary by demographic factors, culture-specific factors and field of study?
- Question 3 What are the graduate school experiences (i.e., academic, social, cultural) of doctoral students enrolled in science and engineering programs? Do these experiences vary by demographic factors, culture-specific factors, field of study and English language proficiency?
- Question 4 What are students' post-graduation plans and how do they differ by demographic factors, culture- specific factors, and field of study?

Question 5 What is the relationship between post-graduation plans and the graduate school experiences of S&E doctoral students when controlling for demographic factors, culture-specific factors, field of study and English language proficiency?

Significance of the Study

Without doubt, we need to pay much attention to the graduate school experiences and career plans of all doctoral students, but it is equally very important to explore issues related to international doctoral student population for in-depth studies and analyses. The presence of these students significantly benefits the U.S. science and engineering fields. Majority of these students bring with them an international perspective and cross knowledge skills that help the U.S. to stay competitive in the global marketplace (Slaughter & Rhoades, 2004). Besides, without understanding broad graduate student experiences, it will be difficult for institutions to find ways to better train these students. Moreover, if these individuals decide to go back to their countries upon the completion of their doctoral programs, the U.S. could lose potential contributions of significantly skilled specialists needed for S&E advancement of the United States.

Given the high number of international doctoral students in S&E programs at most American universities, it is imperative that further research be conducted to examine the factors that influence their graduate school experience and plans after graduation. Research and findings on the factors that influence their graduate school experience and post-graduation plans may be of particular interest to higher education institutions with large international graduate student populations, and for those that intend to admit a larger number of international graduate students in the future. In the same token, if educational practitioners within an academic program fully understand the major

factors influencing students' academic success, more can be done to help retain S&E students in higher education that may have otherwise chosen to depart upon graduation.

Additionally, this research is hinged on the fact that education policy makers will begin to appreciate and better understand how to promote the enrollment and retention of foreign-born S&E students in our universities. In order for the country to stay globally competitive among other developed countries and not face sudden shortage of STEM professionals, and given that the country already has many foreign students and potential completers in doctoral S&E programs, we should care about graduate school student experiences and the factors that shape their decisions to want to stay or return to their countries of origin after graduation. Doing so will ensure that our huge investment in STEM post-secondary education is worthwhile and does not lead to a leaky pipeline of preparing but not retaining future high skilled scientists and engineers. In addition, given the economic dependence of American universities on the revenue accruing from international students' enrollment, it is important to have a clear understanding of their graduate school experiences. An optimum support service is to be provided throughout their sojourn to ensure students do not leave the institution prior to graduation (Ryan, 2005). This is not only the moral duty of Universities as a citadel of learning but is important to attract and retain full-tuition paying international students, which invariably will result in improved recruitment and retention of trained specialists in the country after graduation.

The following chapter provides a literature review focused on the educational experiences of international students. After the review of literature, Chapter 3 focuses on the methodology of this study. Chapter 4 presents the results of the study. Finally, a discussion of the findings is presented in Chapter 5 that also includes the study

limitations, significance of the dissertation, implications for policy and practice, and further research.

Chapter 2

Review of the Literature

Chapter 2 introduces a synopsis of literature pertaining to research on several topics that inform my study. These areas include:

- (a) Trends in international graduate students' enrollment in science and engineering;
- b) The impact of international students and foreign-born workforce in S&E;
- c) Issues of adjustment to a new environment for international students in relations to demographic factors (age, sex), culture-specific factors (race/ethnicity), culture shock, and language proficiency that will be divided into three sections namely language proficiency and academic adjustment, language proficiency and social adjustment, language proficiency and acculturative stress;
- d) International students' post-graduation decisions.

This review of literature will conclude with a discussion of Tinto's Student Integration Model (SIM) and of Berry's Acculturation Model that are informing the theoretical framework of my study.

Trends in International Graduate Students' Enrollment in Science and Engineering

Doctoral education in the U.S. prepares the new generations of faculty and researchers in academia, as well as a highly skilled workforce for the economic growth of our country (Boehlert, 2001; Borjas, 2001; IIE, 2011; Lee, 2008; McMurtrie, 2011; Wulf, 2005). According to the National Academy of Sciences (NAS, 2006) and National Science Foundation (NSF, 2010), the increased presence of international students in doctoral S&E programs and in the scientific and technological workforce is considered to be of increasing importance because the demand for scientists and engineers is higher

now than the number of students graduating in those fields. As cited by Salzman and Lowell (2007), this is even more concerning because the enrollment of American-born students in graduate S&E has not kept pace with that of international students in those programs.

Corley and Sabharwal (2007) reported that the increase in doctoral degrees in science and engineering in the United States is due largely to the increase in international graduate student enrollment. In addition, a significant number of college faculty members in the scientific fields are foreign-born. These authors further added that if the trend continues, we should see large numbers of foreign-born faculty members at U.S. colleges in the future as many of the international graduating PhD students look for academic positions. Current trends suggest that the presence and retention of international students in doctoral S&E programs is crucial for the S&E workforce.

The Impact of International Students and Foreign-born Workforce in S&E

As the world has become increasingly global, concerns are now pointing to the fact that the United States may lose its competitiveness in science, technology, engineering, and mathematics (STEM) to countries like China, and India (National Academy of Sciences, 2006). Scholars and policy makers agree that international S&E students are contributing to the quality of higher education and the economic growth of our country and will continue to represent a great proportion of doctoral-degree recipients in S&E in the U.S. and other industrialized countries (Boehlert, 2001; Borjas, 2001; IIE, 2011). According to these scholars, international students have played an important role in advancing education in our country.

Educational Benefits

Pandit (2007) points out that there are numerous reasons behind the surge of interest in international students in higher education in the United States. First, he posits

that at the national level, there is the recognition that foreign-born students have historically played a key role in advancing U.S.'s research competitiveness in the science and engineering disciplines. Second, with the increasing numbers of international students on the American campuses, it is estimated that their various beliefs, values, and cultures help to promote a multi-cultural environment on campuses (Pandit, 2007).

There are also views that international graduate students are key contributors to the research and development of many U.S. higher institutions. Ren and Hagedorn (2012) claim that international graduate students often play significant roles as research and teaching assistants, as well as help other S&E students in labs and outside of class. These researchers further assert that in their roles as research assistants, international students work with faculty researchers in "funded projects patent and grant applications in the development of publications" (p.135).

Economic Benefits

Apart from educational benefits, and the diversified culture these students bring to American campus, NAFSA (2011) and IIE (2011) reported that international students contributed over \$21 billion to the U.S. economy through their tuition and living expenses during the 2010/2011 academic year. These reports go further to stress the importance of this annual guaranteed source of income to the U.S. government, especially considering that 70% of international student funding comes from sources outside the United States. It is also estimated that the enrollment of international students in graduate science and engineering programs contributes more than \$14 billion annually to the U.S. economy (NAFSA, 2006).

Undeniably, foreign-born scientists, some of them educated in the United States have contributed much to the fields of science and engineering. Earliest studies (Levin & Stephan, 1999) done on the importance of training international students in the U.S.,

stated that a disproportionately larger number of individuals making contributions to science and engineering fields are foreign-born. Most of the contributions are highly cited patents and articles, and membership in esteemed academies such as the National Academy of Sciences (NAS) and National Academy of Engineering (NAE). A much recent finding by Lee (2004), confirms that foreign-born scientists have greater publication success (27% more) than U.S. born scientists, with results varying with the scientist's nation of origin. Overall, research (Carnevale & Fry, 2000; Lin, 2004; NAS, 2003, 2006; Zhao, Kuh, & Carini, 2005) demonstrates that a diverse student body provides far reaching educational and economic values and benefits for American society especially in building a competitive and diverse workforce. Nevertheless, in order to understand the challenges international students experience, an understanding of the issues of adjustment is necessary.

Issues of Adjustment for International Students

Demographic Factors

Age is a factor recognized in the literature as important to the adjustment of international students (Adelegan & Parks 1985; Cheng ,1999; Dunnet, 1981; Olaniran 1996; Poyrazli et al. 2001). Dunnet's (1981) study showed that younger foreign students (between 18 and 22) in the U.S. show greater enthusiasm in the nonacademic aspects of their sojourn. On the other hand, older students (between 23 and 27) seem to be more involved with academic issues and generally more satisfied with their educational pursuits. According to Olaniran (1996), older international students who had difficulties acquiring social skills appear to have more problems due to low English language proficiency. While younger international students reportedly adjust more quickly (Ying & Liese 1994), older international students face the stress of trying to maintain long-distance relationships because they cannot afford to bring their spouse and children with

them (Huntley, 1993). These researchers report that young African students (Adelegan & Parks, 1985) and young Turkish students (Poyrazli et al., 2001) faced less social difficulty compared with older international students in the U.S. Additionally, Poyrazli and Lopez (2007) discovered that while older foreign students reported a high level of perceived discrimination, younger students reported a greater amount of homesickness. Another literature interested in international doctoral students has reported that younger doctoral students are much more social and independent than older doctoral students (Moffett, 2006). Literature also suggests that international students show significant gender-related differences in their sojourn experiences (Fong & Peskin, 1969; Lee, Park, & Kim, 2009). As early as 1969, it was found that female foreign students reported a greater number of adjustment problems adapting in the U.S. compared with male foreign students (Fong & Peskin, 1969). Fong and Peskin (1969) suggest that special problems may exist for women from cultures in which social roles are defined more restrictively than in the U.S. For instance, Japanese and Indian students experience considerable adjustment challenges due to their cultural upbringing and belonging to cultures that are more restrictive than the American culture.

Contrary to earlier gender research on international students (Fong & Peskin, 1969), Ying and Han (2006) more recently found that females had a higher level of adjustment than their male counterparts among Taiwanese students studying in the United States. Lee, Park and Kim (2009) also examined gender differences in academic adjustment among 76 Korean students enrolled in undergraduate and graduate programs in the U.S. Specifically, Lee, Park, and Kim (2009) identified gender as being crucial to the adjustment of international students in institutions of higher education. They too reported in their study that female Korean students showed a higher level of adjustment than males.

Another study conducted by Poyrazli and Lopez (2007) on international students show significant gender-related differences, suggesting that female international students reported a higher level of proficiency in English than their male counterparts. According to Poyrazli and Lopez (2007), possible explanation for this effect is gender role expectation, wherein women are taught to focus on developing relationships, and when they then do so, they get more opportunities to interact and communicate in English. Surprisingly, not many studies have investigated the role of gender as a significant impact on international students' adjustment.

Race/Ethnicity

Empirical studies have consistently demonstrated that international students from particular areas of the world have uniquely differing experiences in their adjustment to the United States. For example, students from regions such as Asia, Africa, and Latin America are more likely to face difficulty adapting in the U.S. due to cultural dissimilarity as well as experiencing racism and discrimination (Yeh & Inose 2003). Trice (2004) adds that international students from African and Middle Eastern countries tend to interact with their American peers less often than students from other regions of the world. However, students from African countries were the most likely to have experienced racial discrimination (Hull, 1978). On the other hand, students from European countries were the most involved with Americans and were pleased with their sojourn experiences in general.

Apart from cultural and racial issues, the geographical similarity between country of origin and host nation also influences the experiences of international students (Klomegah 2006). For example, rural/urban conditions and physical climate of the country that international students come from and its similarity with U.S. might play a role in the adjustment process of international students. Klomegah (2006) further explains that

international students from geographic areas similar to that of the U.S. reported experiencing less stress compared with students from areas that were less similar to the United States. A few other studies also corroborate the above findings. For example, foreign students from Turkey (Bektas, Demir, & Bowden, 2009), Jordan (Alazzi & Chiodo 2006), China (Wang, Sedlacek, & Westbrook, 1992), Japan (Bonazzo & Wong 2007) reported experiencing more stress and difficulty in adjustment compared with international students from European nations (Yeh & Inose 2003).

The Culture Shock Phenomenon

In addition to demographic and culture-specific adjustment issues, international students experience a great amount of culture shock. Attention was first drawn to the phenomena of culture when Oberg (1960) introduced the term culture shock. Since then the role of culture has long been studied in relation to problems related to acculturation. According to Cohen (1968), culture is one of the most important factors influencing the adaptation of individuals. Similarly, international students who come to the U.S. for higher education find themselves in a new cultural environment and experience the overwhelming task of organizing their life to meet the needs and requirements imposed upon them by the new society they find themselves in.

When foreign students move to a new culture for a period of intensive education abroad, they may be exposed to many changes in their environment to which they must adapt before they can function effectively (Hechanova-Alampay, Beehr, Christiansen, & Van Horn, 2002). The same goes to international students in the U.S. Since these students come to the U.S. for higher education from different countries, they may not have English as their native language. As a result, they may experience difficulties understanding class lectures, completing class assignments, speaking in class or expressing their feelings, and making friends with their American classmates. Berry

(1997) believes that because international students are in a new culture, they are faced with the struggles of coping with the new language and situation they find themselves in. Because international students experience the stress of living in an unfamiliar culture and adjusting to life in the United States, including difficulty with English language proficiency, Zhai (2002) adds that helping international students to successfully adjust to U.S. culture and higher education should not be overlooked.

Language Proficiency: Academic Adjustment, Social Adjustment and Acculturative Stress

According to Ward, Bochner, and Furnham (2001), language difficulties can adversely affect life experiences and academic progress for international students. Likewise, international students who have fewer difficulties with language proficiency have better adjustment academically and socially (Yeh & Inose, 2003). As reported in many studies, international students encounter greater problems in their academic adjustment, social adjustment, and acculturation due to language difficulties compared to their American counterparts (Mori, 2000; Sherry, Thomas, & Wing Hong, 2009; Yeh & Inose, 2003). These three categories will be discussed in detail in the following section of this paper.

Language Proficiency and Academic Adjustment

Many studies point out that language proficiency interferes with academic performance of international students (Andrade, 2006; Mclure, 2007; Mori, 2000; Yeh & Inose, 2003). Ying (2003) hypothesized that lack of English language skills would have a negative effect on the academic achievement of new international students at a college campus. In this study, he administered a questionnaire with Likert-type questions to a sample consisted of a group of 155 Taiwanese graduate students in thirty-one states in the United States. The findings from this study indicated that students who had stronger English writing skills had higher academic achievement. While this study used

quantitative analysis, it was limited by the subjectivity of the students' pre-arrival questionnaire. Students may not have had enough time to think about their responses, and this could have affected the validity of the study.

A similar quantitative study by Poyrazli and Kavanaugh (2006) examined if there is a correlation between language deficiency and level of academic achievement. It was hypothesized that language deficiency could predict level of academic achievement for students. Using a questionnaire, the researchers sampled a group that consisted of 149 international graduate students (53% males and 47% females) at five universities in the United States. The findings in this study supported the hypothesis. They found that students with lower levels of English proficiency reported lower levels of academic achievement.

Another quantitative study of 79 graduate students from Turkey indicated that students with higher English proficiency experienced fewer academic adjustment problems (Poyrazli, Arbona, Bullington & Pisecco, 2001). This study also supports previous literature that there is a correlation between language proficiency and academic adjustment.

Language Proficiency and Social Adjustment

A review of previous literature indicates that international students frequently face challenges in adjusting socially to their new environment when studying at American universities (Duru, 2008; Olivas & Li-Chi, 2006). Al-Sharideh and Goe (1998), and Sam (2001) add that social support is therefore very important in ensuring that international students succeed in their new environment. Like other studies, McClure (2007) explains that foreign students are often lonely in their new environment. He reasons that such loneliness emanates from the lack of familiar friends and social network. Further research

emphasizes that developing social network with American students helps international students make successful social adjustment (Lee, 2008).

Another review of literature suggests that language deficiency affect the social adjustment of international students (Andrade, 2006; Kwon, 2009; Mori, 2000; Poyrazli & Kavanaugh, 2006; Yeh & Inose, 2003). Trice (2007) interviewed 27 American and foreign-born graduate faculty members to examine to what extent they perceive that international and native-born students integrate socially and academically. Trice found that international students who had English language difficulties are more likely to experience poor social adjustment. She also found that students who had difficulties forming relationships with American students are more likely to experience isolation from their American peers. Trice's study is different from most previous studies where data is captured using students' perspectives. In this case, Trice (2007) used the perspectives of the faculty members for data collection. She may have reasoned that these faculty members spend a lot of time with the international students; therefore, they are in the right position to provide first-hand information regarding academic and social integration between international graduate students and their American counterparts. However, Trice's study agreed with other studies that language proficiency had an impact on the social experience of international students.

Another qualitative study of 1,100 international students done by Sherry, Thomas, and Wing Hong (2009) examined the academic, social and cultural experiences of international undergraduate students at the University of Toledo, a Midwestern U.S. university with a population of over 16,000. An anonymous online survey (survey monkey) was used for data collection; it did not yield great results. Only 121 of the students responded. Among the issues reported by the students as problems in their adjustment is language proficiency. Students in this study stressed that they had more

problems with spoken English than written English. Consequently, they were unable to interact freely with the domestic students on campus. They also reported that foreign students who socialized with other foreign students tended to experience poorer social adjustment outcomes. One of the weaknesses in this study is the low response rate although the quality of the responses obtained was notable. For example, using open-ended questions in the survey allowed students to voice their opinion as was shown by the in-depth responses from the participants.

Language Proficiency and Acculturative Stress

A further review of literature pointed out that English language deficiency has been shown to be a contributing factor for acculturative stress for international students. Berry (1997) defines acculturative stress as a type of stress associated with the process of adapting to a new culture. Other researchers, Yeh and Inose (2003) explored the effect of age, gender, language fluency, and social support on acculturative stress. They administered demographic and social support questionnaires, and acculturative stress scales to 359 international undergraduate and graduate students at an urban university. They employed multivariate statistics for data analysis and found that the English language accounted for 5.2 % of the variance in explaining acculturative stress. This finding means that participants who are more fluent in English had less acculturative stress. Using multiple methods for data analysis is strengthening this study because it helps to examine data in many ways, thus adding to the validity of the study. However, there are also several weaknesses in this study. First, considering that this is a large urban university, 359 participants were not enough for such a complex analysis. Similar to the above study done by Sherry, Thomas, and Wing Hong (2009), the low response rate may have affected the validity of the results. As a result, this study cannot be generalized to the entire student population at the university or other education institution.

A year later, Poyrazli, Kavanaugh, Baker and Al-Timimi (2004) replicated the study done by Yeh and Inose (2003). The only difference is that they went ahead and eliminated social support as one of the predicting variables on acculturative stress. Still, both studies showed similar findings. In this study, Poyrazli, et al. (2004) surveyed a group of 141 international students from four universities in the U.S. to examine how age, gender, and English language proficiency predict acculturative stress among international college students. The results indicated that higher levels of English language proficiency resulted in lower levels of acculturative stress. This study like others had its limitations of low response rate and small sample size. The latter limits the generalizability of this finding to other student population. The above studies by Yeh and Inose (2003) and Poyrazli, Kavanaugh, Baker and Al-Timimi (2004) both suggested that international students are exposed to culture-related problems in a new environment and this often leads to an inability to cope which is known as culture shock.

International Students Post-graduation Decisions

As stated previously, international students encounter some adjustment difficulties through their educational experiences in American universities. It may not be surprising to find that these students could also face some difficulties making decisions on their future careers and place of residence (i.e., whether or not they should stay or go back to their countries after graduation). Despite the significant implications of the stay or leave decision for international graduate students, a few studies have investigated post-graduation workforce issues and the factors that may influence students' decisions to leave or stay in the U.S. after graduation (Finn, 2005; Florida, 2004; Kim, Bankart, & Isdell, 2010; Shen & Herr, 2004).

There have been however, discussions in the literature about the stay rate of international students after graduation from American universities. Many researchers

believe that the stay rate of foreign-born doctorates vary by country of origin (Finn, 2000, 2003) and by field of study (Finn, 2005). According to Finn (2003), students from Egypt, South Africa, and other African countries have higher stay rate than those from other countries.

Other studies have also mentioned the importance of per capita income of their country of origin in students' decision to stay in the U.S. or return to their home country. For example, Burns and Mohaptra (2008) reported that students' probability of remaining in the U.S. after graduation decrease as per capita income in their home country increases. This is understandable as students would want to improve their quality of life in their home country instead of remaining in a host culture and earning lower income. Although this is a relevant economic indicator, the present study is not concerned with the effect of per capita income in students' decision to stay or return to their home countries after graduation.

Other studies that examined the career trajectory of international students have focused on undergraduates or combined them with some graduate students (Leong & Sedlacek, 1989; Spencer-Rodgers, 2000; Singaravelu, White, & Bringaze, 2005). In the next paragraphs of this study, I will review studies on international undergraduate students regarding career plans and then focus on international graduate students.

First, Spencer-Roger (2000) surveyed a sample of 227 international undergraduate Asian, and non-Asian students to examine their vocational needs. He found that the students in the study were mostly concerned about gaining job-related skills or work experience, and planning for their careers. Overall, most students in this study stressed the importance of enhancing their ability to adapt to the American workforce.

Another study by Singaravelu, White, & Bringaze (2005) investigated career certainty, factors influencing career choice, family influence, and persistence among a sample of 94 Asian international undergraduate students, 50 non-Asian international undergraduate students, and 70 American undergraduate students. These authors found that family may be more important in the career decision making process for international students than for American students.

Although limited, other studies investigated career plans for graduate international students. For example, a qualitative study conducted by Shen and Herr (2004) investigated the career placement concerns and needs of international graduate students leaving the U.S. or staying in the country after graduating. They also examined the patterns of international doctorates' stay versus leave decisions from a historical perspective across period of 1980, 1990, and 2000s. Results from this qualitative study revealed that students had different reasons that influenced their stay or leave decisions. Many wanted to stay in the U.S. after graduation for chances of career promotion, while others expressed the intention to return to their country for needs of the home country. Contrary to Shen and Herr (2004), Saravia and Miranda (2004) only discussed graduate students' in terms of their stay rate after graduation. They stated in their research article that half of internationally-born graduate students studying in the U.S. stay behind even upon completion of their doctoral degree program. Contrary to Shen and Herr (2004), and Saravia and Miranda (2004), Finn's (2010) study specifically focused on international doctorate students and not graduate students in general. In this study, Finn (2010) prepared a report of stay rates of foreign doctorate recipients from U.S. colleges in 2007. In this report, Finn (2010) examined four cohorts' stay rates in 2007 for students receiving doctorate one, two, five, and ten years previously. He concluded that stay rates varied for every cohort. In summary, his study indicated that over a ten-year period (1997 - 2007),

60% of international science and engineering doctorates stayed in America. In comparison, a one-year stay rate (2006 graduates), two-year stay rate (2005), and five-year stay rate (2002) revealed 73%, 67%, and 62% respectively. This means that more recently, the number of international doctoral students who are staying in the U.S. upon the completion of their degree program has increased. Finn (2010) concluded that doctorate recipients from other disciplines namely economics, agricultural sciences, and other social sciences have significantly lower stay rates than do students in S&E.

In summary, research has shown that many foreign students experience difficulties in their academic and socio-cultural adjustment to higher education. The literature review covers these key points:

- a) International doctoral students have a steadily growing presence in science and engineering;
- b) There are educational and economic benefits from the presence of international doctoral students in science and engineering;
- c) Research indicates that international graduate students report satisfaction in their sojourn; however, there are still challenges, namely language difficulties and culture shock. English language proficiency is recognized to have the most crucial impact on the adjustment of majority of international students in American universities. For that reason, English language proficiency will be used to measure international doctoral students' adjustment;
- d) International students' adjustment could vary by age, sex, and country/region of origin;
- e) There are many factors that determine students' decision to stay in U.S. after graduation versus return to home country.

Theoretical Framework

The theoretical frameworks that will guide this study are Tinto's (1993) Student Integration Model (SIM) and Berry's (1997) acculturation model. Given the absence of a comprehensive theory of international doctoral students' graduate school experiences and post-graduation plans within the current literature base, using existing undergraduate model of student integration and acculturation as a starting point to frame this study of doctoral student graduate experiences and post-graduation plans proved useful.

Tinto's Student Integration Model (SIM)

In this theory, Tinto (1993) posits that a student's social and academic integration into an institution is the foundation for students' academic success. One of the criticisms of Tinto's theory is that it does not apply to non-traditional students or those underrepresented in higher education (e.g., African-American). Although Tinto's SIM is usually used to understand the experiences of undergraduate students, for the purposes of this study, the researcher is applying some aspects of the theory to understand the experiences of international students. This study expands the work of Tinto's SIM and contributes to the literature concerning the effect of graduate school social and academic experiences on the post-graduation plans of international doctoral students who are enrolled in S&E at a public university. Tinto first recognizes in his theory that a student comes to school with individual characteristics such as family background, motivation, academic preparation, good study skills, student goals and intent, that influence his or her ability to integrate academically and socially into the campus environment. On one hand, academic integration is viewed as representing the degree to which students interact with faculty, in and outside of the classroom, and the degree to which they become part of the campus culture and institution. On the other hand, social integration represents a student's interaction with peers (Pascarella & Terenzini, 1991; Tinto, 1975).

Also as Tinto himself suggested, students who do not sufficiently integrate into the college environment, socially and academically, run the risk of being isolated in the campus environment.

Using the lens of Tinto's SIM helps the researcher better understand that international students' graduate school experiences which are predicted by their academic and social experiences can affect their choice of post-graduation plans. If these individuals have negative social or academic graduate school experiences, according to Tinto (1993) they have not been socially and academically integrated into the campus environment. For example, international doctoral students might decide to go back to their country, instead of remaining in the U.S. if they had unsatisfying educational experiences. In contrary, a positive academic, cultural, and social graduate school experience could lead to different post-graduation plans. In other words, an international doctoral student who graduated with a degree in science or engineering could decide to remain and work in the U.S. if he or she had positive experiences during their academic journey.

Acculturation Model

Berry (1997) defines acculturation as the social and psychological exchanges that take place when there is continuous interaction between individuals from different cultures. He believes that a student in a new culture has to adapt to his or her new environment. According to Berry (1994), students who are not fully integrated into their new culture might experience what is known as culture shock. In the acculturative model (Berry, 1997), he tries to explain what happens to individuals when they attempt to live or adapt to a new culture.

He explains that individuals either continue to act in their new culture as they did in the previous one, or try to change their behavior, values, and beliefs to adapt to the

new culture. Berry (2003) also notes in his later work that a person exposed to a new culture undergoes a process of change and could adopt one of the four different coping strategies: Assimilation, Separation, Marginalization, and Integration.

During assimilation, a person identifies completely and solely with the host culture while rejecting their culture of origin. Separation means that an individual identifies only with the original culture and avoids identifying with the host culture. Further, a person experiences marginalization when he/she rejects both the host and original culture. Berry asserts that a person in this coping strategy is socially marginalized probably because he/she is detached from both cultures. Lastly, a person using the integration coping strategy shows an interest in maintaining the native culture and also in learning and participating in the host culture. The difference between marginalization and integration is that in integration, the student not only learns about the new culture, he/she actually participates in it. In fact, Berry's acculturation model will be an appropriate model to examine the cultural adjustment of international students. This is because these students are in a new culture, and therefore, are faced with the struggles of coping not only with the new language but the new culture they find themselves in. Tinto's Student Integration Model and Berry's Acculturation Model are appropriate for this study because aspects of these theories apply to international doctoral students present on American campuses and experiencing various social, academic, and cultural challenges.

Chapter 3

Method

This study used quantitative research methods to examine graduate school experiences of international doctoral students in S&E at Richman University (RU) located in the Dallas Fort-Worth Metroplex and how these experiences affect their post-graduation plans. A quantitative approach is most suitable for this exploratory study and in large part, it will allow the researcher to critically look at possible relationships between variables (Creswell, 2009). The study examines the effect of field of study such as science and engineering, demographic factors (age, sex), culture-specific characteristics (race/ethnicity), and self-reported English proficiency on graduate school experiences and post-graduation plans of students. Post-graduation plans will be defined in relation to students' career and personal goals. Their graduate school experiences will be explored along several dimensions such as academic, social, and cultural benchmarks.

This chapter reviews the research questions that have been developed for this study. In addition, this chapter includes information on data collection procedures and survey instrument, the unit of analysis, the population and sample, sampling design used as well as the recruitment of survey respondents. The main part of the chapter focuses on the research design of this study that includes the description and measurement of the study variables, and a discussion of the techniques that will be used to carry out the statistical analyses.

Research Questions

The following research questions will be addressed in this study:

- a) What are the profiles of doctoral students in science and engineering? How do they vary by demographic factors (i.e., age, sex), culture-specific

characteristics (i.e., race/ethnicity), and field of study (i.e., science or engineering)?

- b) Do the adjustment abilities of doctoral students in science and engineering measured by their self-reported language proficiency vary by demographic factors, culture-specific characteristics and field of study?
- c) What are the graduate school experiences (i.e., academic, social, cultural) of doctoral students enrolled in science or engineering programs? Do these experiences vary by demographic factors, culture-specific factors, field of study and English language proficiency?
- d) What are students' post-graduation plans and how do they differ by demographic factors, culture-specific factors, and field of study?
- e) What is the relationship between post-graduation plans and the graduate school experiences of S&E doctoral students when controlling for demographic factors, culture-specific factors, field of study and English language proficiency?

Data

Available Data Source

The data for this study were gathered at a large Public University (RU) located in the Dallas-Fort Worth Metroplex. The RU serves about 33,500 students, who attend more than 180 degree programs in 12 different schools and colleges. This university offers 71 masters and 30 doctoral degrees in nine different academic areas: Architecture, Business, Education and Health Professions, Engineering, Liberal Arts, Nursing, Science, Social Work and Urban and Public Affairs. In 2013, RU enrolled 7,478 graduate students with 1,992 students in the science and engineering fields. Of these, 1,479 (74.2%) are in engineering while 513 (25.8%) are in science. In engineering, international graduate

students ranked first place with 1,016 students comprising 68.7% of the total graduate student population. Although the numbers of international graduate students in science are not as high as in engineering, they comprise 139 (27.1%), ranking the second largest. Overall, the international student population combined makes up more than half (58%) of the entire graduate student population in science and engineering.

A review of data received from the Institutional Research and Planning (IRP) office in March 2013 revealed that about 500 (25%) out of the 1,992 science and engineering graduate students are in the doctoral program. Further examination of same IRP data over the past eight years shows lower graduation and retention rates for international doctoral students in science and engineering (30-60%) compared to the masters S&E students who have about 80-90% graduation and retention rate. Graduation is defined as students who completed their program, and retention rate means students who stayed in the RU's graduate program without dropping out. However, the data for non-international S&E students revealed an even much lower graduation and retention rate for both masters (50-60%) and doctoral (20-50%) students than that reported for international students.

Data Collection Procedures

Prior to the recruitment of participants, submission of the study proposal was sent to the Institutional Review Board (IRB) at the researcher's institution. After the IRB approval (Appendix B), the researcher contacted the Office of International Education (OIE) for assistance in recruiting the doctoral students in science and engineering. This was done in order to address concerns about privacy of participants, and not allowing the researcher to have direct access to the email addresses of the participants. With few exceptions (participants who agreed to disclose their emails to the researcher for being entered in a drawing to receive \$50 gift card), only OIE had access to students/emails.

Further, a recruitment letter describing the purpose and nature of the study, and an IRB approval letter showing that researcher obtained valid permission to conduct the research were e-mailed to all the participants. An email reminder to complete and submit the surveys was equally distributed by OIE through students' e-mails after the initial invitation. Each e-mail had a link to the online survey administered by SurveyMonkey.com. Participants were prompted to click yes or no if they consented or not to participate in the research study. If they clicked yes, they were directed to the survey (see Appendix E). Otherwise, they exited the website.

Finally, an e-mail was sent to remind students about the closing date of the survey link. Upon survey completion, data was imported into Statistical Package for the Social Sciences (SPSS) for analysis.

Pilot Study

Prior to this research, I conducted a face-to-face pilot study in the fall of 2013 on five international doctoral students in science and engineering. The purpose of my pilot study was to explore if my survey would be appropriate for the study. I had anticipated that the survey will take about 30-35 minutes to complete. After I had conducted the pilot study, I found that the survey took about 20-25 minutes to be completed. Conducting the pilot study gave the researcher the opportunity to clarify the questions to the participants and to discover how much time was needed to complete the survey. Fortunately, there were no modifications made in the survey instrument because the participants felt that the survey was clear and easy to understand. Although the research design was appropriate for the study, I had to change the wording in the recruitment letter that the survey will take only 20-25 minutes to complete. As an incentive for participating in the pilot study, all the students: three from sciences and two from engineering program each received a \$10 gift card.

Population and Sample

The target population in this study is the international doctoral students in the science and engineering (S&E) fields enrolled at RU during the fall 2013. The target population is based on the most recent updated list of students available at the Office of International Education. The sampling strategy was to invite all the international doctoral students enrolled in the S&E fields in the 2013-2014 academic years to participate in the study in order to ensure a large sample size.

Participants

Invitation was sent to about 500 international doctoral students at RU in October 2013. On December 14, 2013 (after about 1.5 months), I received 129 responses, which corresponds to a response rate of about 26%. Of the 129 respondents, about 91 students answered the survey and provided demographic information, English skills, influencing factors to enroll in doctoral program, and financing background information. About 15 students did not finish the survey on college experience and post-graduation plans. Of the 129 responses, 75 students completed answers on the main focal variables and had acceptable data on other variables to be included in the study. Therefore, the sample size for the study is, (N=75). The final response rate of 15% is comparatively consistent with recent research which found that response rates tend to be lower in online than paper surveys. In his research study, Sax (2003) found online response rates ranging from 17.1% to 19.8%. On the other hand, paper response rates ranged from 22% to 24%. According to Schwab (2002), the minimum sample size requirement is 10 respondents per independent variable. For (eight) predictors in this study, the minimum sample size would be 80. This means that this study's sample size of 75 closely satisfies the sample size requirement for the most complex analysis which is a multinomial regression model.

The responding students consisted of 53.3% Asian, non-Hispanic, 32% White, non-Hispanic, and 14.7% other minority groups. Of the sample, 68% were male and 32% were female. The sample included 50.7% and 49.3% in the science and engineering program respectively.

An online survey method was chosen for this study for a number of reasons. Compared to paper survey, a large amount of data can be collected in a short amount of time. This method facilitates a quicker and more accurate way for data collection (Creswell, 2009) because it minimizes sources of error and generates coded data (Nardi, 2006). Additionally, students can access an online survey from any computer with internet access. The data can be exported directly from the web-based tool to a Microsoft Excel spreadsheet and easily analyzed using a statistical program. However, there are a few disadvantages to online surveys.

Participants who are inexperienced web users may be frustrated by online surveys. Others may be dissuaded from completing the survey for fear that information transmitted through the web is not secure or for fear of lack of privacy. Nosek, Banaji and Greenwald (2002), add that survey questions can be answered randomly or abandoned if there is no one present to clarify the questions. Overall, the researcher believes that the benefits of online surveys outweigh the drawbacks.

Potential Sample Non-response and Sources of Error

The researcher is aware of the fact that no matter how carefully a study is designed and conducted, some targeted participants may not respond, Attention ought to be given to international students who chose not to participate in the study since non-participants, even insignificant number, could affect study results to a certain degree. There could be reasons why some international students may have chosen not to participate in this study. Some of the reasons could be due to lack of time, discomfort to

reveal personal information, English language barriers, misunderstanding of the importance of social science research.

There might be various sources of error before, during, or after the data collection process. Biemer (2010) emphasizes that "Careful planning is required for allocating resources to the various stages of the survey process so that the potential sources of error are controlled to acceptable levels" (p.821). He adds that poorly designed survey instruments can be a major source of measurement error. He cautioned that survey questions should be free from ambiguity and devoid of any confusing instructions. With this in mind, the researcher ensured that the survey questions were short, concise, direct, complete and easy to understand. In fact one of the strengths of this study is that the pilot study helped to validate the survey instrument for data collection.

Specifically, in order to minimize the effects of measurement errors, the researcher:

- 1) reviewed the survey items thoroughly
- 2) asked the dissertation chair, and a colleague in another doctoral cohort to internally review the survey questions.

To further handle non-response error, the researcher sent follow-up invitations to non-respondents with minimal inducement with the intention to get a higher return rate. Several researchers (Martin & Loes, 2010; Simmons & Wilmot, 2004; Singer, 2002) comment that offering incentive to participants has been shown to be effective in increasing response rates in surveys. For this reason, survey respondents who completed the survey and were interested in winning a Wal-Mart gift card worth \$50 in a lottery were asked to provide their names, e-mail address and mailing address. Three

random names were selected and the winners were notified through e-mail. Finally, three Wal-Mart gift cards worth \$50 each were mailed out to three students.

Research Design

Description of Survey Instrument

Due to lack of survey instruments to assess international doctoral students' graduate school experiences and post-graduation plans, a survey instrument containing 36 questions was developed by the researcher specifically for this study (See Appendix E). The survey items were developed based on the information gathered during literature review that focuses on international students. In this survey, students were asked about their graduate school experiences and post-graduation plans. Several cues were added to the survey to help the students better understand the survey questions.

It is important to point out that the survey instrument is much broader than the study focus and not all survey items were used to address the research questions. Specifically, only 11 out of the 36 survey items were used for this study. Remaining survey items are intended to be used in future research concerning the international doctoral students who are enrolled in S&E at RU that will be conducted by the researcher. Considering the time involved in administering the survey, the researcher believes contacting students once is more efficient than administering further surveys.

The first part of the survey contains questions on students' demographic (age, sex), culture specific characteristics (race/ethnicity), field of study (science and engineering), and language skills questions. The second part focuses on students' graduate school experiences (academic, social, and cultural) while the third part of the survey deals with students' plans after graduation. Some of the survey items are Likert-scale type and others are closed-response multiple choice questions that are easy to answer. Due to the language barriers that international students often encounter, closed-

ended questions are used because the students may not be comfortable to respond to an open-ended questionnaire. The survey instrument used for the pilot study concluded with a section about how students believed the survey questions for the actual study could be improved (question 35 and 36). After conducting the pilot study, questions 35 and 36 were eliminated from the study prior to online administration.

Variables and Constructs

The dependent variable in this study is students' post graduation plans and is a categorical variable. Graduate school experience will be described by a set of continuous measures serving as predicting/independent variables for post graduation plan. Other five categorical variables (age, sex, race/ethnicity, field of study, and English skills) will be used as independent variables. Detailed information on variables and their categories is presented below:

Age

In the survey, question #2 asks students to report their age. The question comprised of three categories ranging from 20-25, 26-30 to over 30. Since students may be of different age levels, using a wide age range allowed the researcher capture all students' age groups.

Sex

Question #3 in the survey asks students to report their sex. This variable has two categories: male and female

Region of Origin vs. Race/Ethnicity

In the survey, question #4 asks for students' country of origin. Since the study involves international students, it is possible that they may come from different regions of the world. However, asking students in the survey to provide what region they come from might be confusing and ambiguous, hence the need to be more specific to elicit the

correct answers. This also prevented a situation whereby some students might not know exactly how to respond to the question of region of origin. Conversely, students were given the option of listing their country of origin.

After data collection, there were some missing data on country of origin along with the fact that country of origin information has too much variability (and thus too small numbers for some countries) and needed to be aggregated into regions of origin. Overall, this information did not appear to be reliable so the researcher decided to use race/ethnicity (as a proxy for region of origin) because this variable was better defined in students' responses. These are the compositions for race/ethnicity: White, non-Hispanic (most of them declared USA & some from Europe, Middle East); Asian, non-Hispanic (most of them from India some from Bangladesh, Nepal, Pakistan, China, S. Korea, and Taiwan); Other-- under-represented minorities (URM) from Mexico, Spain or Africa, Caribbean, USA). More details about the race/ethnicity composition are explained in the data analysis section.

Field of Study

Survey question #10 allowed international students to report their field of study. This variable has only two categories - science and engineering. Only these two fields of study are included in the survey because the study is designed for doctoral students who are enrolled in science and engineering only.

English Language Skills

In the survey, questions 19, 20, and 21 allowed students to self-report their ability to speak, read, and write English. However, only an overall English score is considered for analysis which is obtained as an average of the three English scores (speaking, reading, writing). The overall English score is then classified as a 2- category variable: 1=Some difficulties (scores less than 4 indicated that the student is more or less

deficient in at least one component and 2=No difficulties (scores equal 4 correspond to very good skills on all components. These were the two categories for ranking students' overall English language proficiency.

Students' ability to speak, read, and write English was examined separately but not reported in the study. English language skills are crucial competencies that students need to have to be able to succeed in graduate school in the U.S. Generally, doctoral students are expected to exhibit demonstrable academic knowledge in speaking, reading, and writing English. They have to be able to speak and communicate effectively while presenting their research papers either to their peers and professors, or at a research conference. They also need to be able to read English well in order to understand and comprehend research articles, and academic material. Lastly, they need writing skills to be able to complete their class assignments, comprehensive exams, and even complete their dissertation papers.

Graduate School Experiences

Three sets of multiple survey items (i.e., questions 28, 29, and 30) were used to measure students' academic, social, and cultural graduate school experiences. Here, responses were rated on a 6-point Likert-type scale ranging in value from 1 (strongly disagree) to 5 (strongly agree) with 0 (not applicable).

This scale means that the value of "1" indicates that a student has negative graduate school experiences, while the value of "5" means that a student has positive graduate school experience. These items were further used to derive several variables that described the academic, social and cultural dimensions of graduate school experience. The techniques were discussed in the 'Data analysis procedures' section.

Post-graduation Plans

Lastly, survey question #31 was used to collect information on post-graduation plans. This dependent variable has three categories ranging from 1 (Stay in U.S. and find a job or continue education); 2 (Go back to own country- immediately/after working in U.S.); 3 (Not sure/work anywhere in the world). The variables described above are listed in Table 3.1.

Table 3.1 Constructs and Variables

Variable/construct	Categories
Individual characteristics	
Age	3-category variable (1= 20-25; 2=26-30; 3= Over 30)
Sex	2-category variable (0=male; 1=female)
Race/Ethnicity	3-category variable (1= White, non-Hispanic; 2= Asian, non-Hispanic; 3= Other -- under-represented minorities (URM))
English skills	2-category variable (1=Some difficulties; 2=No difficulties) ; This variable corresponds to overall English skills computed as an average of speaking, writing, reading scores and then aggregated into 2 categories
Field of study	2-category variable (1=science; 2=engineering)
Graduate School experiences	3-composite scores based on aggregating survey items that fall under the hypothesized academic, social and cultural dimensions
Post-graduation plans	3 categories (1= Stay in U.S. and find a job or continue education; 2 = Go back to own country- immediately/after working in US; 3= Not sure/ work anywhere in the world)

Data Analysis Procedures

The first step in the process of the data analysis was to import the survey data from survey monkey into Statistical Package for the Social Sciences (SPSS) software,

version 21 for statistical analysis. The SPSS data set imported included the individual scores of the participants on the major variables in the study. Data analysis procedures for each research question are described below and summarized in Table 3.2.

Research question 1: What are the profiles of doctoral students in science and engineering? How do they vary by demographic factors, (age, sex), culture-specific factors (race/ethnicity), and field of study (science or engineering)?

In exploring the first research question, descriptive statistics using frequencies and percentages were used to obtain the counts and percentages describing the profile of doctoral students in science and engineering. Cross-tabulations were further employed to show the age, sex, and race/ethnicity distributions by field of study. The advantage of the cross-tabulation technique is that it yielded, in addition to the simple frequencies and percentages of each variable, a more in-depth analysis of the relationships between these variables.

Research question 2: Do the adjustment abilities of doctoral students in science and engineering measured by their self-reported language proficiency vary by demographic factors (i.e., age, sex), culture-specific factors (i.e., race/ethnicity) and field of study (science or engineering)?

Since all the variables are categorical, cross tabulations as (descriptive statistics) were used followed by chi-square tests to compare the percentages and find whether there is association between students' self-reported language proficiency and age, sex, race/ethnicity, and field of study. P-value set at lower than 0.05 will be considered as a statistically significant result.

Research question 3: What are the graduate school experiences (i.e., academic, social, cultural) of doctoral students enrolled in science and engineering programs? Do

these experiences vary by demographic factors (i.e., age, sex), culture-specific factors (i.e., race/ethnicity), field of study (science or engineering), and English language skills?

Because graduate school experiences (academic, social and cultural) measures will be obtained as composite scores of several items, this will produce three continuous variables that will be compared across various factors using ANOVA. The ANOVA tool is an appropriate statistical analysis to determine if there are statistically significant differences between the mean scores of the dependent variable when comparing groups (categories) of specific independent variables or factors (Gall, Gall, & Borg, 2007). The survey questions developed under graduate school experiences consist of 51 items measured on a 6 point Likert-type scale.

Although I anticipated to have 13 items to build the academic college experiences construct, 21 items for social graduate school experiences construct, and 17 items for cultural graduate school experiences construct, factor analysis was conducted to confirm that items indeed are loading three factors and the selected items fall under the right construct. Therefore, in order to reduce all the 51 items to three factors and create composite scores for academic, social, and cultural graduate school experiences, a confirmatory factor analysis was conducted. This analysis allowed the researcher to combine variables that are “moderately” or “highly” correlated with each other (Gall, Gall, & Borg, 2007, p.371). Furthermore, three reliability analyses for each set of items identified as building the academic, social and cultural graduate school experiences scales were conducted to find the Cronbach’s coefficient alpha range for the scales. Cronbach’s coefficient alpha indicates the internal consistency of the scale.

Once all 51 items were correctly classified under one of the three scales, or eliminated if they were ambiguously loading more scales, and Cronbach’s alpha calculated, the corresponding items were used to obtain composite scores for the

academic, social and cultural dimensions of graduate school experiences. For addressing Research question 3, these three variables were used as dependent variables in the ANOVA tests. They were further used as explanatory variables for Research question 5.

Research question 4: What are students' post-graduation plans (e.g., Stay in U.S. and find a job or continue education; Go back to own country-immediately/after working in U.S.; Not sure/work anywhere in the world) and how do they differ by demographic factors (age and sex), cultural- specific factors (race/ethnicity) and field of study (science or engineering)?

Since all the variables are categorical, I used cross tabulations as descriptive statistics followed by chi-square tests to compare percentages and show the association between students' post-graduation plans and age, sex, race/ethnicity, and field of study.

Research question 5: What is the relationship between post-graduation plans and the graduate school experiences of S&E doctoral students when controlling for demographic factors, culture specific characteristics, field of study, and English language proficiency?

A multinomial logistic regression (MLR) was conducted to examine the relationship between the dependent variable (post-graduation plans) and all the independent variables included in the analysis. Multinomial logistic regression was an appropriate analysis to be used here because it has been widely adopted in analyzing categorical variables when the dependent variable has more than two groups. In this study, the dependent variable (post-graduation plans) has likely three groups namely: Stay in U.S. and find a job or continue education, Go back to own country-immediately/after working in U.S., Not sure/work anywhere in the world. Table 3.2 shows the research questions, the variables and statistical procedures that will be used in this study.

Table 3.2 Research Questions, Variables, and Statistical Procedures

Research Questions	Variables	Statistical Procedures
1	<u>Field of Study</u> Age Sex Race/Ethnicity	Frequency tables Cross-Tabulations
2	<u>English language skills</u> Age Sex Race/Ethnicity Field of Study	Cross-Tabulations Chi-square tests ($p < 0.05$)
3	<u>Graduate School Experience</u> Age Sex Race/Ethnicity Field of Study English language skills	Factor Analysis Reliability Analysis ANOVA tests ($p < 0.05$) Paired Sample T- Tests ($p < 0.05$)
4	<u>Post-graduation Plans</u> Age Sex Field of Study Race/Ethnicity	Cross-Tabulations Chi-square tests ($p < 0.05$)
5	<u>Post-graduation Plans</u> Graduate School Experience constructs Age Sex Race/Ethnicity Field of study English language skills	Multinomial Logistic Regression

Chapter 4

Results

This chapter presents the findings of the study. Results were obtained by analyzing collated data through the SPSS (described in detail in the data analysis section) in an attempt to respond to the research questions presented. Frequency tables and cross-tabulations were used to analyze the first research question. The chi-square tests were used to analyze the second and fourth research questions. This was followed by factor analysis, t-tests, and the ANOVA tests for the third research question while a multinomial logistic regression method was utilized to test the fifth research question. Details of the questions and analyses are as follow:

Profiles of International Students

Research Question 1 What are the profiles of doctoral students in science and engineering? How do they vary by demographic factors (age, sex), culture-specific factors (race/ethnicity), and field of study (science or engineering)?

In addressing this research question using SPSS analysis, data for the study was gathered from 75 students (N=75) or 15% of the 500 international doctoral students enrolled in S&E. First, frequencies and percentages were assigned for the students' profiles. This was followed by cross-tabulations of age, sex, and race/ethnicity by field of study.

The results of this descriptive analysis are presented in Table 4.1. The table provides the distribution of students in science and engineering field by demographics.

Table 4.1 Demographic Information by Field of Study (Column %)

Variables	Science	Engineering	Total
Age			
20-25	11 (29%)	9 (24%)	20 (27%)
26-30	19 (50%)	17 (46%)	36 (48%)
Over 30	8 (21%)	11 (30%)	19 (25%)
Sex			
Male	20 (53%)	31 (84%)	51 (68%)
Female	18 (47%)	6 (16%)	24 (32%)
Race/Ethnicity			
Asian, Non-Hispanic	14 (37%)	24 (70%)	40 (53%)
White, Non-Hispanic	15 (40%)	9 (24%)	34 (32%)
Other	9 (24%)	2 (5%)	11 (15%)
Total	38 (51%)	37 (49%)	75 (100%)

The above data revealed that about 51% of respondents were enrolled in the science program, while 49% were enrolled in the engineering program. It also goes to show that of 75 respondents sampled, (68%) were male and (32%) were female and almost half of the respondents (48%) fall within the 26-30 age range. About the same number of students are aged 20-25 or 27% of the entire sample. Those that aged above 30 years only constitute 25% of the sample.

Relationship between Age and Field of Study

The sampled data was examined separately for each group of students to find if there is a link between age and field of study. The reported data for the age groups revealed that almost half (46%) of the students in the engineering program are 26-30 years old, followed by students aged 30 or over (30%). It also revealed that students

within the 20-25 age group were the least represented in the engineering programs (24%). Similarly, for the science programs, students aged 26-30 (50%) were the most represented followed by students who fall within the 20-25 (29%) age group. Unlike in engineering, the table for science shows that students over 30 years (21%) were the least represented in the program.

Relationship between Sex and Field of Study

Of the seventy-five students sampled in this study, 68% indicated that they were male while 32% were female. The results tend to show that the number of female students (47%) enrolled in the science program is very close to the number of male students (53%). Conversely, the report show that the number of male students (84%) enrolled in the engineering programs is more than five times the female with only 16% of the sampled.

Relationship between Race/Ethnicity and Field of Study

The summary of the relationship between race/ethnicity and field of study is detailed in the following paragraph. The result of the foregoing descriptive analysis shows that there is a relationship between students' race/ethnicity and field of study. The three racial/ethnic groups used in the study were Asian, non-Hispanic, White, non-Hispanic, and students classified as "other" racial group. The data revealed that students in the "Other" racial group were the least represented in the science program (24%). The disparity between the White, non-Hispanic (40%) and Asian, non-Hispanic students (37%) in the science program was not that significant. However, the data from the engineering program yielded different results. Here, the number of Asian, non-Hispanic students outnumbered the other two racial groups. The data also revealed that almost three-quarter (70%) of the students enrolled in the engineering programs were Asian,

non-Hispanic as compared to 24% White, non-Hispanic and 5% other ethnic group in the engineering field of study.

Section Summary

The results of data revealed that there were more students enrolled in the science than the engineering program. In terms of age, almost half of the participants were in the age group 26-30. There are about the same number of students in the other two age groups. Findings from this study suggest that there are older students in engineering and a mixture of younger and older students in the science program. In terms of sex, there are more males than female in the study. Unsurprisingly, there are more males than female enrolled in both the engineering and science program.

On race/ethnicity, the report revealed that students in other racial/ethnic group were the least represented in both fields of study. Asian, non-Hispanic students outnumbered the other two racial/ethnic groups in the engineering program. However, there are about the same number of Asian, non-Hispanic and White, non-Hispanic students in the science program. When it comes to the race/ethnic composition, Asian, non-Hispanic students make up more than half of the responding students. The least represented ethnic group is students in the other racial/ethnic category.

In summary, these differences in race composition provided the sample with some geographical balance. Also, the spread of ages gives the study a good representation of various age ranges. It will be noted however that most of the students sampled in the study were males. Naturally, this skewed sample characteristic may influence survey responses and outcomes chiefly for the reasons of unfair comparison since twice as many male than female students participated in this study.

Self-Reported Language Proficiency

Research Question 2 Do the adjustment abilities of doctoral students in science and engineering measured by their self-reported language proficiency vary by demographic factors (i.e., age, sex), culture-specific factors (i.e., race/ethnicity) and field of study (science or engineering)? This was analyzed using cross tabulations and Chi-square test shown below.

English Language Skills and Age Groups

Students were asked to self-report their abilities to speak, read, and write English. For the purpose of this study, the overall average scores were calculated rather than treating this measure as continuous variables. I created a 2-category variable describing English skills to differentiate students who reported very good skills across all components so had No difficulties with English from those who experienced Some difficulties (less than very well on at least one component). The aggregation of English skills categories was needed because of the relatively small sample size that would lead to small counts for some categories.

There were 75 students who responded to this question. Overall, results showed that more students (57%) reported that they had some English language difficulties than those that responded otherwise (43%). A closer examination of data suggested that more than half (51%) of the respondents who reported that they had some language difficulties are in the 26-30 age categories. The other two age groups were slightly different. Specifically, about 26% of students aged 20-25 on one hand and 23% of students 30 years and over reported some language difficulties. Interestingly, 44% of students aged 26-30, (28%), 20-25, (28%) 30 years and over indicated that they had no language difficulties.

A Pearson's chi - square test of independence variable was performed to examine the relationship between age and English language skills. The results show that the relationship between these variables was not statistically significant, $\chi^2 (1, N=75) = .426, p > 0.05$. This is a slight departure from some preliminary studies done on the subject. Earlier in this paper, it was stated that some other researches indicated significant age-correlated differences in language proficiency. They tend to state that older international students appear to have more problems in their studies due to significant low English language proficiency.

English Language Skills and Sex

Results of the chi-square statistics failed to reveal any statistically significant relationship between English language skills and gender, $\chi^2 (1, N=75) = 1.91, p > 0.05$. Based on this result, it can therefore be safe to conclude that the relationship between English language skills and sex is not significant.

Although the result was not significant, it is important to note that 74% of male respondents reported more language difficulties as compared to (26%). Similarly, more male (59%) than female (41%) students reported no language difficulties.

English Language Skills and Race/Ethnicity

Of all the three racial groups, the Asian, non-Hispanic students (65%) reported the most language difficulties than did their White, non-Hispanic (19%), and 'Other' racial group (16%) counterparts. Half (50%) of the White, non-Hispanic students said they had no problems with speaking, reading, or writing English. Clearly, this number is much higher than the numbers reported by Asian, non-Hispanics (38%), and "Other" racial ethnic group (12%). Table 4.2 shows the relationship between these two variables.

Table 4.2 Cross-Tabulations between English Language Skills, Demographic Factors and Field of Study (column %)

Factors	Some Difficulties	No Difficulties	Total	Sig. p-value
Age				
20-25	11 (26%)	9 (28%)	20 (27%)	ns
26-30	22 (51%)	14 (44%)	36 (48%)	($p>0.05$)
Over 30	10 (23%)	9 (28%)	19 (25%)	
Sex				
Male	32 (74%)	19 (59%)	51 (68%)	ns
Female	11 (26%)	13 (41%)	24 (32%)	($p>0.05$)
Race/Ethnicity				
Asian, non-Hispanic	28 (65%)	12 (38%)	40 (53%)	sig. $p = .02$
White, Non-Hispanic	8 (19%)	16 (50%)	24 (32%)	
Other	7 (16%)	4 (12%)	11 (15%)	
Field of Study				
Science	18 (42%)	20 (63%)	38 (51%)	ns
Engineering	25 (58%)	12 (37%)	37 (49%)	($p>0.05$)

A Chi-square test result indicates a statistically significant relationship between English language skills and race/ethnicity $\chi^2 (1, N=75), = 8.45, p = .02$. In other words, there is a statistically significant relationship between race/ethnicity and overall English skills.

English Language Skills and Field of Study

When comparing the level of English language difficulties between the science and engineering students, data suggested that more engineering (58%) than science

(42%) students said they had some difficulties speaking, reading, and writing English. On the other hand, more science (63%) than engineering (37%) students reported no language difficulties, $\chi^2(1, N=75) = 3.13, p > 0.05$. The chi-square test shows that there was no statistically significant relationship between English Language skills and field of study.

Section Summary

Unlike age and sex, race/ethnicity was found to have a statistically significant effect on English language skills. Overall, more students reported that they had some language difficulties. Of all the three age-ranges, students who are between the ages of 26-30 reported the most language difficulty. Older students reported the least language difficulties than younger students contrary to previous literature (Olaniran, 1996) on the subject suggesting that older students have more difficulties with English language than younger students. In terms of sex, males reported more language difficulties than females. Although there was no significant relationship found between English language skills and field of study, descriptive analysis revealed that engineering students reported the most language difficulties while students in the science program reported the least concerns with respect to language proficiency.

Graduate School Experiences

Research Question 3 What are the graduate school experiences (i.e., academic, social, cultural) of doctoral students enrolled in science and engineering programs? Do these experiences vary by demographic factors (i.e., age, sex), culture-specific factors (i.e., race/ethnicity), field of study (science or engineering), and English language skills?

The first step in analyzing data for this research question was to perform a factor analysis. As a way to aggregate the 51 survey items about students' graduate school

experiences into cultural, social, and academic experiences (as assumed conceptually and explored through the survey instrument). I performed a Principal Component Analysis (PCA). This is an exploratory factor analysis using Varimax rotation. Factor analysis was used for the purposes of identifying survey items loading three factors prior to creating composite scores for these dimensions. Only 40 survey items loaded the factors with differences of at least 0.2 between components in the Rotated Component Matrix. I dropped 11 survey items that were ambiguous and had comparable loadings across segments

After identifying the survey items loading each factor, for each scale, I conducted reliability analysis to assess the internal consistency. Cronbach's alpha was used to measure the internal consistency reliability coefficient for the three subscales:

Cultural global values (17 items)

Social involvement (13 items)

Academic experiences (10 items).

Cronbach's alphas for these scales were examined and all of them were high. For instance, the 'Cultural global values' scale which had 17 items had an alpha level of .934 indicating that the items were highly correlated with each other. The other scale of 'Social involvement' had a Cronbach's alpha of (.941) and the scale of 'Academic experiences' had a Cronbach's alpha of .859.

Composite scores for each scale were calculated. Social, cultural, and academic experiences were used as dependent variables in the One-way Analysis of Variance (ANOVA) tests to compare the means across various independent variables. Following the ANOVA, a paired sample t-tests was used to test whether there are significant mean differences in scores for the social, cultural and academic experiences components.

ANOVA Tests

In each of the ANOVA test, the dependent variable was students' graduate school experiences measured separately by the three composite scores discussed above, while the independent variables (factors) are age, sex, race/ethnicity (a proxy for measuring region of origin), field of study and overall English language skills. ANOVAs were conducted to determine whether significant differences existed in graduate school experience variables across age, sex, race/ethnicity, field of study and English language skills. An alpha level of 0.05 was used for all analyses. Furthermore, Levene's test for homogeneity of variance was used to indicate that the assumption underlying the application of ANOVA was met. For independent variables with more than 2 categories (e.g., age, race/ethnicity), if ANOVA test was significant, the least significant difference (LSD) post hoc multiple comparison test was then used to determine which means differed statistically significant from the other on each graduate school experiences. The following paragraphs contained the results of ANOVA test conducted to compare the students' graduate school experiences by all the independent variables on the students' graduate school experiences.

Graduate School Experience and Age

The ANOVA tests were used to determine whether students' age affects their cultural, social and academic graduate school experiences. The independent variable has three different types of age groups: 1) 20-25; 2) 26-30; and 3) over 30. The dependent variable was the students' graduate school experiences-cultural, social and academic. One-way ANOVA test did not show any statistically significant differences between age groups based on social and academic scores. Results revealed social effect as - $F(2, 72) = 2.04, p = .138$; and academic- $F(2, 72) = .607, p = .548$. However, a significant relationship was found for cultural experiences scores.

Table 4.3 shows the means and standard deviations for age and cultural experiences. The ANOVA yielded statistically significant effect for the interaction between graduate cultural experience and age. Table 4.4 displays the one-way ANOVA test for cultural graduate school experiences by age.

Table 4.3 Means and Standard Deviations for Age and Cultural Experience

Age Group	N	Mean	SD
20-25	20	4.50	.459
26-30	36	4.20	.462
Over 30	19	4.09	.531

Table 4.4 Analysis of Variance for Cultural Experiences

Source	SS	df	MS	F	p
Between	1.854	2	.927	4.03	.022
Within	16.569	72	.230		
Total	18.423	74			

The above data revealed a statistically significant main effect for cultural $F(2, 72) = 4.03, p < .05$ indicating that students' cultural experiences differed by age groups with the youngest group showing higher awareness of cultural global values.

Post hoc comparisons using LSD procedures were used to determine which pairs of the three age group means differed. These results were given in Table 4.3 above and indicate that the mean score for students 20-25 ($M = 4.51, SD = .459$) were significantly different than scores for students between the ages of 26-30 ($M = 4.20, SD =$

.462), and students above 30 years ($M = 4.10$, $SD = .531$). Put together, the statistically significant results in cultural graduate school experiences suggest that students age 20-25 reported more positive cultural experiences than the other age groups. It is also right to conclude that students over 30 years had the least positive cultural experiences among the three age groups.

Graduate School Experience and Sex

A One-way analysis of Variance revealed that there are no significant effect of sex on students' cultural, social, and academic graduate school experiences. No significant difference existed between male and female in the mean scores for the cultural - $F(1, 73) = .056$, $p = .813$; social - $F(1, 73) = .001$, $p = .975$ and academic- $F(1, 73) = .504$, $p = .480$. These results suggest that graduate school experiences did not vary by sex.

Graduate School Experience and Race/Ethnicity

A One-way Analysis of Variance was also conducted to determine the effect of race/ethnicity on graduate school experiences for international doctoral students who are enrolled in S&E. Again, there were no significant differences found on the mean scores measuring cultural, academic and social experiences at the 0.05 level among the three race/ethnicity groups. Scores from the test showed cultural- $F(2, 72) = .846$, $p = .433$, social- $F(2, 72) = 1.90$, $p = .157$; and academic- $F(2, 72) = 1.464$, $p = .236$. Since the ANOVA test was not significant, a post-hoc test was not reported.

Graduate School Experiences and Field of Study

Similar to sex, race and ethnicity, ANOVA test results showed that cultural, social, and academic graduate school experiences were not affected by students' field of study. The between group data for cultural is $F(1, 73) = .287$, $p = .094$; social - $F(1, 73) = .297$, $p = .588$; and academic - $F(1, 73) = .313$, $p = .578$.

Graduate School Experience and English Language Skills

A One-way Analysis of Variance (ANOVA) was used to determine whether cultural, social and academic graduate school experiences differ by English language skills groups (students experiencing some difficulties, and students experiencing no difficulties). The dependent variable was the students' graduate school experiences. It reveals that both academic and social experiences were not statistically significant for the two English skills groups. The results showed social- $F(1, 73) = 1.46, p=.230$; and academic- $F(1, 73) = 2.38, p=.131$.

Conversely, the data support that there is a statistically significant difference in students' cultural experience - $F(1, 73) = 6.289, p < .05$. Table 4.5 presents the means and standard deviations for cultural experiences scores by English skills groups and Table 4.6 provides information for the ANOVA statistical analysis.

Table 4.5 Means and Standard Deviations for Cultural/English Language Skills

English Language Skills	N	Mean	SD
Some difficulties	43	4.13	.455
No difficulties	32	4.41	.517
Total	75	4.26	.499

Table 4.6 Analysis of Variance for Cultural/ English Language Skills

Source	SS	df	MS	F	p
Between	1.854	2	.927	4.03	.022
Within	16.569	72	.230		
Total	18.423	74			

Paired Sample T-Tests

The paired sample t- tests were used to determine whether there is a statistically significant difference in the mean scores for social, cultural, and academic graduate school experiences. There was a significant difference in the mean scores between cultural ($M=4.26$, $SD = .499$) and social ($M=2.18$, $SD=.812$); $t(74) = 19.355$, $p = .000$. Likewise, a significant difference was found between academic ($M=4.15$, $SD = .574$) and social ($M= 2.18$, $SD = .811$); $t(74) = -18.986$, $p = .000$. No significant difference was found in the mean scores for cultural and academic experiences scores. Data reveals that the mean score for social experience was the lowest of all three graduate experiences. This means that the students had low social involvement compared to academic involvement and cultural experiences. It is interesting that students with lower English proficiency are slightly more likely to socially involve in campus events.

Section Summary

There were no significant effect of age on respondents' social and academic experiences, but not so on their cultural experiences. While younger students reported the most positive cultural experiences, older students had the most negative cultural experiences. Surprisingly, result from ANOVA revealed that participants in the study did not experience any negative academic and social experiences due to language difficulties. This result contradicts the findings of previous research on the issue suggesting that international students experience academic, social, and acculturative stress during their educational journey in the United States (Yeh & Inose, 2003). Several research studies, point out that English language difficulties have been a great factor that affect the academic (Andrade, 2006, McLachlan & Justice, 2009) and social (Andrade, 2006, Gonzales, 2004) adaptation of international students to American campus life.

In addition, findings using the paired sample t-test revealed significantly low mean scores for social experience, suggesting that international students are not getting involved on campus. When compared to academic and cultural experiences, students reported the most negative social experiences in graduate school. This conclusion seems to support the notion expressed earlier in the literature review that international students experience social adjustment challenges due to poor English language skills (Andrade, 2006; Kwon, 2009; Mori, 2000; Poyrazli & Kavanaugh, 2006; Yeh & Inose, 2003). However, doctoral students in S&E who are less proficient in English are trying harder to establish social connections and be involved in campus events.

Post Graduation Plans

Research Question 4 What are students' post-graduation plans (e.g., 1 = Stay in U.S. and find a job or continue education; 2 = Go back to own country- immediately/after working in U.S.; 3= Not sure/work anywhere in the world) and how do they differ by field of study (science or engineering), demographic factors (age, sex), culture specific factors (race/ethnicity), English language skills, and graduate school experiences?

Post Graduation Plans and Age

The largest proportion (44%) of the respondents who reported that they would stay in the U.S. after graduation were 26-30 years followed by those ages 20-25 and over 30 years who had similar results with 28%. Those students ranging in age from 26-30 and over 30 had the same numbers of students and were the most to indicate that they wanted to go back (37.5%). The smallest proportion of the respondents who reported that they would go back after graduation was 20-25 years old. Other students were undecided about their post graduate plans. In particular, 69% of those of 26-30, 26% of 20-25 years old, and 5% of older students had unclear post-graduation plans.

A chi-square test of independence was performed to examine the relationship between age and post-graduation plans. The relationship between these variables was not significant $\chi^2(4, N= 75) = 6.90, p >0.05$ suggesting that post-graduation plans did not differ by age.

Post Graduation Plans and Sex

Data from this analysis show that 69% of male students reported that they would stay in the U.S after graduation. Same responses were given by 21% of female students sampled. It was also found that 75% of males and only 25% of females indicated that they would like to go back to their countries after graduation. Results revealed that more male (58%) than female (42%) fell into the category of students who were undecided about their graduation plan or wanted to work anywhere in the world.

A chi-square test of independence was performed to examine whether there is a relationship between sex and post-graduation plans. Similar to age, the relationship between these variables was not significant $\chi^2(2, N= 75) = 1.44, p > 0.05$. Hence, the conclusion is that post-graduation plans do not differ by sex. However, descriptive statistics showed that more females compared to males said they were not sure about their graduation plans or that they would like to work anywhere in the world.

Post Graduation Plans and Race/Ethnicity

As discussed earlier in this study, race/ethnicity will be used as a proxy for region of origin. Findings in this study showed that exactly half (50%) of the White, non-Hispanic students planned to stay in the U.S., as compared to 41% of Asian, non-Hispanic, and 9% of students of other race/ethnicity. Planning to go back to their country of origin after graduation was reported by 79% of Asian, non-Hispanic, 13% other race/ethnicity, and 8% of White, non-Hispanic. Furthermore, Asian, non-Hispanic students were the most likely (42%) to have undefined post-graduation plans or intend to go anywhere in the

world after graduation. Thirty-two percent of White, non-Hispanic and 26% of Asian, non-Hispanic students were undecided in terms of post-graduation plans.

A chi - square test of independence was performed to examine the relationship between race/ethnicity and post-graduation plans. Unlike the results obtained previously for age and gender, this study found that there is a positive relationship between these variables, $\chi^2(4, N= 75) = 14.31, p <0.05$. Hence, the conclusion is that students' post-graduation plans differ significantly by race/ethnicity. The percentages of race/ethnic groups in each post-graduation plan are shown in Table 4.7.

Table 4.7 Post-graduation Plans by Race/Ethnicity

Race/Ethnicity	Stay in U.S. and find a job or continue education	Go back to own country- immediately/after working in U.S.	Not sure/work anywhere in the world	Total
Asian, Non-Hispanic	13 (41%)	19 (79%)	8 (42%)	40 (53%)
White, Non-Hispanic	16 (50%)	2 (8%)	6 (32%)	24 (32%)
Other	3 (9%)	3 (12.5%)	5 (26%)	11 (15%)

The chi-square test result can be seen below in Table 4.8.

Table 4.8 Chi-square Test for Race/ethnicity and Post-graduation Plans

Pearson Chi Square	14.309	4	.006
Likelihood Ratio	15.093	4	
# of Valid Cases	75		

As can be clearly seen in the above analysis, the majority of White, non-Hispanic S&E doctoral students intend to stay in the U.S. upon graduation while almost three-quarter of the Asian students intend to go back to their own country.

Post-Graduation Plans and the Field of Study

The current study examined if students' field of study affects their post-graduation plans. Data from this study reveal that more science (56%) than engineering (44 %) students said they would stay in the U.S. upon graduation. On the contrary, more engineering (67%) than science (33%) students reported that they would like to go back to their countries. The remaining students, 63% science and 37% engineering responded they were not sure/work or planned to work anywhere in the world. Overall, the percentage of students who want to stay in the U.S. (43%) outnumbered students who expressed interest to want to go back to their country of origin (32%) and those who said they were not sure or want to work anywhere in the world (25%).

Again, a chi-square statistical test was performed to examine the relationship between field of study and post-graduation plans. Similar to the results obtained previously for age and sex, this study found that there is no statistical significant relationship between these variables, $\chi^2(4, N= 75) = 4.470, p = >0.05$. Therefore, the present study did not find a correlation between post-graduation plans and field of study

Section Summary

In comparing student's post-graduation plans by age, sex, race/ethnicity and field of study, this study found no significant effects with the exception of race/ethnicity. Although there were very little significant differences, descriptive analyses were used to present some important patterns. Based on the above data, the oldest age group indicated they were more likely to intend to stay in the U.S. after graduation as compared to the younger students. This result is surprising considering that older students were reported to have more negative cultural experiences than younger students.

Although more male than female respondents reported that they want to stay in the U.S. after graduation, the percentage of males who reported that they would want to

stay is not much higher than that of the females. Overall, the males were also more interested than females to go back to their countries after graduation. While more science students want to stay in the U.S., more engineering students want to go back to their own country. More science than engineering students responded that they were not sure of their post-graduation plans or would like to work anywhere in the world if given the opportunity.

Post-graduation Plans and Graduate School Experiences

Research Question 5 What is the relationship between post-graduation plans and the graduate school experiences of S&E doctoral students when compared to field of study, demographic factors (age and sex), culture specific characteristics (race/ethnicity), and English language proficiency?

To answer research question 5, a Multinomial Logistic Regression (MLR) was employed to examine the relationship between the dependent variable (post-graduation plans) and a set of predictor variables. Eight independent variables: age, sex, race/ethnicity, field of study, English language skills, and graduate school experiences (cultural, social, academic) were used as a pool of predictors for post-graduation plans. Multinomial Logistic Regression was employed in this analysis because the dependent variable, post-graduation plans, has more than two categories as is seen in a binary logistic (Tarling, 2009). The dependent variable is categorized into the following three groups: 1= stay in the United States and get a job or continue education, 2 = go back to own country immediately/or after working in the U.S., 3 = not sure/work anywhere in the world. Table 4.9 contains descriptive statistics of all variables employed in the model.

Table 4.9 Descriptive Statistics of Variables used in the MLR Model

Variables	N	Marginal Percentage
Age		
20-25	20	26.7%
26-30	36	48.0%
Over 30	19	25.3%
Sex		
Male	51	68.0%
Female	24	32.0%
Field of Study		
Science	38	50.7%
Engineering	37	49.3%
Plans		
Stay and find a job or continue education	32	42.7%
Go back to own country immediately/after working in the U.S	24	32.0%
Not sure/work anywhere in the world	19	25.3%
Race		
Asian, non-Hispanic	40	53.3%
White, non-Hispanic	24	24.0%
Other Asian, non-Hispanic	11	14.7%
English Skills		
Some difficulties	43	57.3%
No difficulties	32	42.7%
Total	75	100%

In the MLR analysis, any category of the dependent variable can be chosen to be the reference group. The category, 'stay in the U.S.' was used as the reference group or baseline category that was compared to each of the other two post- graduation plans. The first step in MLR is to describe the overall test of relationship between the independent and dependent variables. A model chi-square test termed 'model fitting

information by means of likelihood ratio tests' was calculated using SPSS. Table 4.10 showed evidence of a relationship.

Table 4.10 Model Fitting Information

Model	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 log likelihood	Chi-square	df	Sig.
Intercept Only	161.381			
Final	121.917	39.463	20	.006

Therefore, it can be concluded that at least one independent variable can significantly affect the dependent variable (post-graduation plan). Another helpful step while conducting a MLR analysis was to obtain the Exp (B) which is the odd ratio associated with each ordinal independent variable or levels of categorical independent variables. An odds ratio Exp (B) greater than 1.0 showed that as a continuous independent variable increased, the odds of the outcome increased; an odds ratio greater than 1.0 for a category of an independent variable indicates a higher likelihood of the outcome as compared to the reference category of same variable (Tabachnick & Fidell, 2007). However, the closer the odd ratio is to 1.0, the less influence it has on the continuous independent variable in predicting the outcome and/or the more similar is the categories of the categorical independent variable with respect to the outcome.

In the MLR analysis, two comparisons were made by using two categories of the dependent variable and then examining the odd ratios for each independent variable (Table 4.11). The reference category for these two comparisons is 'stay in the U.S. which is contrasted with: a) students who want to go back to their countries compared to the students who want to stay in U.S.; b) students who are not sure about their graduation

plan/want to work anywhere in the world compared to students who want to stay. Table

4.11 Multinomial logistic regression ('Stay in U.S.' = ref group)

Variables	Reference Categories and levels	Odds Ratios	
		Go back	Not sure / work anywhere in the world
Age	Age 20-25 = ref		
Age (1)	Age over 30	1.6	.2
Age (2)	Age 26-30	1.1	2.0
Sex	Male = ref		
	Female	1.5	2.9
Race	Asian = ref		
Race /Ethnicity(1)	Other	1.1	2.8
Race/Ethnicity (2)	White	.1*	1.0
Field of study	Engineering = ref		
Field of study (1)	Science	.6	.8
English	No difficulties = ref		
Skills	Some difficulties	4.5*	7.3*
Cultural	Ordinal variable	.8	4.0
Social	Ordinal variable	1.2	.6
Academic	Ordinal variable	1.1	1.1
Likelihood ratio tests Chi-Square		39.463*	
*p < 0.05	Nagelkerke R ²	.46	

The information Table 4.11 also shows the Nagelkerke R^2 of 0.463 indicating that 46.3 percent of the variability in outcome is explained by the set of variables used in the MLR model.

When comparing 'stay in U.S.' and 'go back to own country', two significant odd ratios were noted for (a) race/ethnicity and (b) English language skills. First, it is significantly less likely for the White, non-Hispanic students to plan going back to their country versus staying in the U.S. However, it is significantly more likely for students who experience some English language difficulties to plan going back to their country. When comparing 'stay in U.S. and 'not sure/ working anywhere', one significant odd ratio was noted for English language skills. It is significantly more likely for students who experience some English language difficulties to have unclear plans.

It is also important to point out here that the small numbers of significant findings in the multinomial logistic regression model could be attributed to small sample size. When the sample size is small and tests are less reliable, descriptive statistics is still very relevant to show the trends, especially in an exploratory study. It is therefore very important to highlight the fact that all the variables used in this analysis are distinct and require consideration. This is why all the variables and odd ratios are reported in the next section in Table 4.11. I organized the next section in this chapter into two parts based on the two comparisons discussed previously.

Results of Multinomial Logistic Regression

Relationship between Stay in U.S. and Go Back to Own Country

Below are the discussions of the odd ratios for age, sex, race/ethnicity, field of study, English language skills, and graduate school experiences when comparing the two categories of the outcome variables: 'stay in U.S.', and 'go back to own country'.

Age: For age comparison, students ages 20-25 years were used as the reference group. Results indicated that the oldest age groups: students ages 26-30 (OR = 1.1) and 30 and over (OR = 1.6) were more likely to go back to their countries than younger students when compared to those who want to stay. This data is contrary to the previous finding in this study that found that older students compared to younger student want to stay in the U.S.

Sex: For sex comparison, males were used as the reference group. In disagreement with the earlier finding in this study, participants who were female (OR = 1.5) compared to male were more likely to go back to their countries rather than stay in the U.S. after their postgraduate studies.

Race/Ethnicity: Here, the Asian, non-Hispanic students were used as the reference group. A statistically significant relationship existed between race and the dependent variable "go back to your own country" ($0.033 < 0.05$). Similar to previous findings in this study, White, non-Hispanics students (OR = .147) were less likely than students in 'Other' racial group (OR = 1.1) to fall in the groups of students who wants to go back to their countries than those who want to stay in U.S. It also means that Asian, non-Hispanic students were more likely to indicate their interest to go back to their countries than White, non-Hispanic students.

Field of Study: Similar to previous findings, science students (OR = .6) were less likely to go back to their countries than the engineering students when compared to those who want to stay in the U.S. One can also conclude that students in the science field are more likely to stay in U.S. than the engineering students. It can also be interpreted that engineering students are more likely to go back to their countries than stay in the U.S.

English Language Skills: Data clearly showed statistically significant relationship between English language skills and post-graduation plans ($p=0.047$). This means that

students with some language difficulties (OR = 4.5) were more likely to go back to their countries than those with no language difficulties. There was no prior result on English language skills earlier on in the study to compare with the findings here in the MLR. Earlier on in this study, students' post-graduation plans were measured against some independent variable; age, sex, field of study, and race/ethnicity. English language skills were not included in the analysis. Therefore, the conclusion in this study is that students with language difficulties are more likely to return to their country of origin upon the completion of their studies.

Graduate School Experiences: In this analysis, the researcher sought to discover if participants' decisions to go back to their countries or stay in U.S. were associated with their social, academic and cultural experiences. First, data showed that students who had negative cultural experiences (OR = .8) were less likely to be in the group of participants who intend to stay in the U.S. rather than the group of students who want to go back. On the other hand, as indicated in table 4.11 above, students with positive social (OR = 1.2) and academic (OR = 1.1) graduate school experiences were only slightly more likely to be in the group of participants who want to stay in the U.S. rather than go back to their countries.

Relationship between 'Stay in U.S.' and 'Not Sure/Work Anywhere in the World'.

Below are the discussions of the odd ratios for age, sex, race/ethnicity, field of study, English language skills, and graduate school experiences when comparing the two categories of the outcome variables: 'stay in U.S.', and 'not sure/work anywhere in the world'.

Age: Of all the age groups, students who are 26-30 years (OR = 2.0) were more likely to be undecided about their post graduation plans or want to work anywhere in the world when compared to staying in the U.S. Older students ages 30 and above were less

likely to be uncertain about their plans after graduation. These results are similar to the previous descriptive data in this study when age and post-graduation plans were compared.

Sex: Female students (OR = 2.9) were more likely than male students to be in the group of respondents who were indecisive about post-graduation plans or indicated they would want to work anywhere in the world, rather than the group of respondents who want to stay in the US. This odd contradicts the earlier finding in this study that did not find any statistically significant differences between sex and post-graduation plans. In fact, earlier descriptive data showed that males were more likely to be indecisive than females.

Race/Ethnicity: The finding here is inconsistent with previous findings in the first comparison because there was no statistically significant relationship between race/ethnicity and the dependent variable 'not sure/work anywhere in the world'. Although there was no significant relationship found, there were some high odd ratios worthy of discussion. For example, students in 'Other' ethnic (OR = 2.8) were more likely than the White, non-Hispanic (OR = 1.1) to be in the group of students who said they were not sure of their post-graduation plans or would want to work anywhere in the world.

Field of Study: Data indicated that science students (OR = .8) were less likely to be uncertain about their post-graduation plans than engineering students when compared to planning to stay in the U.S. This odd ratio contradicts earlier descriptive data in this study suggesting that science students were more likely to be uncertain about their post-graduation plans. Although more science than engineering students as revealed earlier on in the study plan to stay in the U.S., it does not mean that they are more certain about their intention after graduation. Therefore the relationship between sex and post-graduation plans is inconclusive in this study.

English language skills: Furthermore, a statistically significant relationship was noted between English language skills and post-graduation plans ($p=0.015$). This means that students with some language difficulties ($OR = 7.3$) were highly more likely to be uncertain about their post-graduation plans or want to work anywhere in the world than stay in the U.S. as compared to those with no language difficulties.

Graduate School Experiences: Results in this analysis revealed that students with positive cultural ($OR = 4.0$) and academic ($OR = 1.1$) experiences were more likely to plan leaving the U.S. and go somewhere else. Whereas, students who have positive social experiences were less likely to be unsure or go anywhere in the world versus staying in the U.S ($OR = .6$)

Section Summary

Research question 5 is an extension of the fourth research question which examined post-graduation plans. The only difference is that multinomial logistic regression (MLR), a multivariate statistics method was used in analyzing data. Unlike the chi-square analysis used in research question 4 which examines the relationship between 2 variables, MLR allowed the researcher to examine the combined effect of several predictors on the outcome variable. MLR also allowed the researcher to identify areas where important relationships exist between the independent and dependent variables that ordinarily would not have been identified with the other types of data analysis.

Inconsistent with earlier findings in this research study, MLS has shown that older international doctoral students were more likely to go back to their countries than younger students. It was also found that females were more likely than males to go back to their country of origin. Again the odd ratio (OR) results show that White, non-Hispanic students were less likely than Asian, non-Hispanics to go back than stay in the U.S. In

terms of field of study, science doctoral graduates were less likely to plan to go back or more likely plan to stay in U.S. than engineering students after graduation.

Unsurprisingly, results from the model validates previous findings in this study suggesting that students with language difficulties were more likely to report that they want to go back to their countries. Additional findings here revealed that students with negative cultural experiences were more likely to go back to their home countries. On the other hand, students who expressed positive social and academic experiences were more likely to stay in the U.S. upon completion of their degree program.

Chapter 5

Discussion

This chapter includes the discussion/interpretation of the findings, limitations and strengths of the study, significance of the dissertation or its relevance to the higher education, STEM doctoral education for international students, immigration issues for international students, and graduate school experiences as well as its implication for policy and practice and for future research.

Adjustment of International Students in American Universities

Many studies conducted on the adjustment of international students in an English speaking culture show that apart from such factors as homesickness, culture shock, loneliness, and acculturative stress/anxiety (Furnham, 1998; Oberg, 1960; Olaniran, 1996, 1999; Yeh & Inose, 2003), English language proficiency is recognized to have the most crucial impact on the adjustment of majority of international students in American universities. For the purposes of this study, “adjustment” is defined as students’ academic and language skills factor.

Similar to what the literature suggests, the present study has also shown that language is a major problem in the adjustment of international students at this public university. The result of the present study indicated that more than half (57%) of the respondents reported that language was a major problem in their adjustment. Given that these students travel to the U.S. for higher education from different countries, they do not have English as their native language. As a result, they may experience some difficulties understanding class lectures, completing class assignments, expressing their feelings, and makings friends with their American classmates (Galloway and Jenkins, 2005; Lee, 2010; Lo, 2002; Mori, 2000; Poyrazli, and Grahame 2008; Sherry, Thomas & Wing Hong, 2009; Yeh and Inose, 2003). Invariably, these scholars assert that, language

inadequacies and the lack of close friendships make it difficult, if not impossible for international students to adapt culturally, academically, and socially.

The current study explored the relationship between English language skills and race/ethnicity. The study findings revealed that English proficiency did contribute to the variance in students' cultural experience. Students with higher levels of English proficiency such as the White, non-Hispanic students tended to experience less negative cultural experience. However, greater degrees of language difficulties experienced by Asian, non-Hispanic students were predictive of their negative cultural experiences. In fact, results from my study indicated that compared to Europeans, Asian students reported greater adjustment difficulties due mainly to their lack of English language skills. This result supports previous research (Yeh & Inose, 2003) indicating that English language proficiency is related to a lower level of adjustment.

It is possible that the Asian students may have experienced language difficulties because English is not spoken as a native language in their countries. This lack of exposure to the English language may have been the initial source of their problems when they moved to the U.S., an English speaking country. Having language difficulties or not being able to communicate well with peers, especially in a new country could be a reason for these students' inability to interact with American students to get to learn their culture.

It could also be that some of these students come from restrictive home environments where socialization overtures with people outside of their homes are prohibited, or restricted. Such groups of student prefer staying in the company of students from their own country so that they lose touch with the U.S. born students who could impact their lives culturally. One could even assume that the Asian students had language problems because they lacked social skills or had no friends at the university.

Other studies confirm that students from non-European countries (Poyrazli, Kavanaugh, Baker, & Al-Timimi, 2004) have difficulties interacting with the American students. On the other hand, students from Europe were reported to interact more with American students. It therefore seems reasonable to assert that Asian, non-Hispanic students and students from other ethnic groups in this study may have experienced many language challenges arising from lack of interaction with their American classmates. As other studies have shown, students from Europe tend to adjust better to campus life in an English speaking country (Yeh & Inose, 2003). Again this could explain why the White, non-Hispanic students expressed least concerns with English language skills.

Another important factor to consider in explaining this language proficiency disparity is likely that the White-non-Hispanic students must have been in the U.S. much longer than the other racial groups. A majority of these students may have even been born in the United States, or have interacted more with their American peers, giving them comparative advantage in English Language proficiency when compared with the other set of students.

The present study did not examine length of stay and the effect it may have on language proficiency or on overall adjustment ease of international doctoral students in American Universities. Also, this study did not examine any relationship between students' interaction with American students and language proficiency. The aforementioned could be areas for further studies.

What Are Their Experiences?

Researchers have drawn attention to the need to create positive campus climate that support international student adjustment to academic and social demands of college life (Schweitzer, Morson, & Mather, 2011). This is realization that international students face plethora of demands, including navigating different social and cultural norms,

language difficulties, building friendships, and challenges associated with distances between their home cultures and their host culture (Mori, 2000). With the increasing enrollment of international students in American schools, there has been a growing interest in investigating the factors that influence the educational experiences for international students. The increasing number of international students in the United States does indicate that they may have problems with their experiences in a host culture (Lee, 2010).

In fact, researchers have shown that international students have more challenges than their American peers because of their social and academic background (Lee, 2010; Mori, 2000; Yeh & Inose, 2003). According to (Moore & Popadiuk, 2011), many international students experience great challenges without receiving adequate support. This makes imperative a detailed study in this area of high education. An earlier review of literature in the present study also attest to the fact that international students do experience social, academic, and cultural challenges during their academic journey in this country (Yeh & Inose, 2003).

My study findings have also demonstrated that the international doctoral students whom participated in my study shared most of the similar challenges highlighted in the literature, including, social and cultural challenges, language-related difficulties, race/ethnicity-related issues, and demographic-related factor such as age. Even though these doctoral students have acquired some academic knowledge and have spent several years of their lives in school in or out of this country, they still experience difficulties and by extension some adjustment issues.

Regarding research finding on age and adjustment of international students, Moffett (2006) found that older international students are much less social than younger students. Others suggested that younger international students face less social difficulty

and adjust more quickly than older international students (Poyrazli et al., 2001). This age group may be socially more mobile and interactive than their older peers, thus increasing their potential to integrate and assimilate.

My research is in an agreement with the literature findings and earlier studies that show that age may play a role in cultural experiences. For example, data from this present study revealed that younger international students reported better cultural experiences than the older students. Since these students are younger, and still in the exploratory stage of their lives, they are more open to meet with people from different cultures. Although students in this study were not asked to rate their social interactions with American students, one can infer that younger foreign students interacted more socially with other Americans and American students. As a result, they are more likely to acquire new tenets of the new culture than their older colleagues. This interaction may help them overcome any cultural difficulties or literally break cultural boundaries than these other students, who may be held down by age-acquired change resistance. In other words, it is most likely that the older students experienced greater cultural dissatisfaction because of their high degree of resistance to change. They are probably more likely to be settled in their ways such as (e.g., lifestyles and social interaction) or may also have different world views and expectations than the younger students.

Additionally, older students may be married, or probably left their families in their home countries. As a result, they may be trying to work in addition to their school obligations to make ends meet. Huntley (1993) pointed out that older students may be trying to maintain long-distance relationships when they travel abroad because they cannot afford to bring their spouse and children with them. Possibly, family and school obligation may prevent these students from making out time to socialize with the domestic students. Consequently, they are not able to interact with the domestic students

as often as their younger classmates, thereby denying themselves of their ability to gain in language and other socio-cultural skills.

Previous research findings on sex and adjustment of international students, revealed sex-related differences suggesting that female international students may encounter greater number of adjustment problems than males (Olaniran, 1996). Yet, others claim that female students show a higher level of adjustment than males (Lee, Park, and Kim, 2009). In addition to these findings, especially as they pertain to English language proficiency, Poyrazli and Lopez (2007) said there is significant information to support the notion that female international students reported a higher level of proficiency in English language than their male counterparts. However, my research finding is incongruous with these earlier studies. In my case, findings have shown that there is no significant relationship between sex and self-reported language proficiency. Based on available literature review, it is hard to draw a conclusion as to which sex experiences the most difficulties in language proficiency.

As evidenced in the present study, the research sample is composed of twice the number of males than females. In support of the study findings, research indicates that worldwide, females compared to males are still less represented in the science and engineering fields (Richman & VanDellen, 2011). In their recent report, these scholars stated that women in the U.S. and other developed countries are increasingly entering the traditionally male-dominated fields of study like science and engineering. For example, the National Science Foundation (2008) reported that the number of women who earned doctorates in engineering in the U.S. in 1958 increased by 19% compared to the previous year to 20%. The same foundation also claimed that women are even assuming faculty positions in engineering in many Universities. Although women still face challenges in the field of science and engineering, they are coping effectively with their

minority status in these fields (Richman & VanDellen (2011)). Surprisingly, fewer studies have examined sex role as an important factor in student adjustment.

What Are the Post-graduation Plans of International Students?

The study findings seem to support the statement in the literature (Finn, 2010) that more international students, especially those in science and engineering reported that they would stay in the U.S. upon graduation instead of going back to their home countries. Finn (2010) concludes that doctorate recipients from other disciplines, namely economics, agricultural sciences, and other social sciences have significantly lower stay rates than do students in S&E. Not only does this study support the preceding notions, but it also uncovered what race/ethnicity has the best predictive role.

Results from multivariate statistical analysis reveal that White, non-Hispanics students were more likely to stay in the U.S. upon degree completion than the other racial groups. A study done by Klomegah (2006) strengthens the above assertion. He found that students from the European countries and geographic areas similar to that of the U.S. in terms of language and culture reported less adjustment difficulties than students from other regions. With less adjustment issues as reported by Klomegah(2006), it becomes easy for one to appreciate the reason why more White, non-Hispanic students in the present study indicated that they intend to stay in the U.S. after graduation. Sharing the same perspective as Klomegah (2006), Lee (2010) also believes that individuals from non-Western countries face greater challenges due to the need to negotiate cultural and linguistic differences.

Other researchers (Trice, 2004; Yeh & Inose, 2003) reported that students from African and Asian countries evidently were more likely to be unsatisfied with their educational experiences, mainly due to issues bothering on language proficiency and adaptability. The above report is congruent with the findings in this study inferring that

Asian, non-Hispanic students were more likely to go back to their countries than stay in the U.S. Definitely, there is a connection here: one can assume that these students want to go back to their country of origin because they feel they are not acculturated enough to continue to stay and work in the host country after graduation.

One can also speculate that students who want to stay in the U.S. after graduation may do so because they want to gain employment and improve their economic status and that of their families in their original countries. Some may want to stay for better job opportunities here in the U.S. especially if an employer is willing to sponsor them to get their permanent resident card permitting them to stay and work here legally.

On the other hand, some international students intentionally expressed their desires to return to their countries after completing their studies. Amongst these students are those who indicated that they have some language challenges. These students want to go back to their countries probably because their language deficiency and communication difficulties seem to be interfering with their studies or even with their social, academic or cultural adjustment. In line with the preceding argument, Andrade (2006) also identified English language proficiency, culture, support services, and educational background as influential toward the academic achievement of international students. Additionally, many researchers have investigated how students' language proficiency in English language, affect their adjustment (Poyrazli, Arbona, Nora, McPherson & Pisecco, 2002; Swami, Arteché, Chamorro-Premuzic, & Furnham, 2009).

In terms of sex, it is likely that more males than females said they would go back probably because of the societal role expected of men as the head of family in their native countries. They might want to go back and get a job to help support their families back home. Another reason is that these foreign male students may have had previous

positions in their country and they need to return to their professional obligations after graduation. Some students may have been sponsored financially to travel abroad and study. After their studies, they may be obligated to return back to fulfill their contractual obligations. Others may be doing so because of their strong family ties and attachment to their countries (Singaravelu, White, & Bringaze (2005).

Expectedly, study findings suggested that females were more likely than males to stay in the U.S. after graduation. This is likely because females may have better adjustment in the U.S. as opposed to their countries of origin, with less opportunity for personal growth and actualization. In addition, most foreign countries have gender gaps issues where females are treated as second-hand citizens and inferior to men, whereas, women trained in the U.S., especially in science and engineering fields may have more opportunities getting the job here than facing uncertainties in their native countries. Lastly, female international students may have reported a desire to stay in the U.S. after graduation because they realize that the role of women is expanding in the American society today, women are becoming more independent and present in the workplaces thus overcoming outdated gender stereotypes.

Limitations of the Study

This study does have a few limitations that should be considered. The most important limitation relates to a small sample size employed in the analysis. In one instance, only one set of students in the engineering and science programs from one university was examined. The population being studied is limited to doctoral S&E students at one such public university. Consequently, the results and conclusions derived from this study cannot be generalized easily to other colleges/institutions (Creswell, 2009) in the U.S. without some margin of errors. Again, given the small sample size, this

study did not uncover many significant differences in students' graduate school experiences and post-graduation plans.

While the response rate is fairly consistent with those reported for other online surveys, a 15% participation rate is low. The relatively low response rate could have been due to the timing of the survey. The survey was administered towards the end of the semester. Many doctoral students may have declined to participate due to time pressure for final assignments and submitting of research papers, or preparation for final examinations. Language barriers may have also discouraged some students from participating, given that more respondents in this study had language difficulties. As noted, during the survey process, some of the respondents were not able to complete the survey online.

Other possible explanation of low response rate to the online survey is that the researcher could not be in direct contact with the targeted population. Dillman (2007) recommended that a link with a personalized e-mail should be sent to each participant in the study rather than sending a mass e-mail. Unfortunately, due to confidentiality reasons, the researcher was not able to access students' personal e-mail addresses to exploit this option. As a result, the international students in this study were reached through the Office of International Education (OIE). The mass e-mail and the limited follow-up reminders to students might have also affected the response rate (15%). In fact, only one reminder to respond to the survey was sent to elicit respondent participation in an attempt to increase the sample size.

Another limitation of this study is that it might not have addressed all aspects of students' graduate school experiences and post-graduation plans. These factors may include but are not limited to socio-cultural factors, socio-economic factors, psycho-social factors, and effect of length of stay on experience, etc. Therefore, future studies should

explore these and other aspects related to international Students' graduate school experiences and post-graduation plans. Doing so will be helpful in gaining a holistic understanding of the experiences of international students which invariably will help in the formulation of appropriate academic/public policies to address the issues identified.

Finally, this study relied heavily on students' self-reported English language proficiency to measure students' adjustment abilities. Using self-reported responses could be a threat to internal validity because the credibility of the data is dependent on the authenticity of their responses to the survey items. For example, students' responses may or may not be accurate because it is the assumption of student based on his/her cognition.

Strengths of the Study

There are several strengths of this study. One of the strengths in this study is the use of multiple data analysis procedures. By employing both descriptive and inferential statistical data analysis, the researcher was able to extract pertinent information to validate study findings and examine consistency of results. For instance, the results obtained from the paired sample t-test, Chi-Square and ANOVA tests yielded consistent results. The only difference in data results was within the multivariate analysis. This is good for the credibility of the study (Creswell, 2008).

Perhaps the greatest strength of this study is the survey development and the strength of the survey. This research was a very important experience for me. Developing the survey gave me the opportunity to interact with higher education, and I was able to contribute to the growing body of knowledge in the study on international students by designing the survey that was used in this study. Although the data collection itself was poor, the survey instrument was good and reliable as evinced by the results of the Cronbach's alpha for the three variables that was loaded in the factor analysis. All three

composite scores exceeded the mark of .70 which was considered acceptable. To ensure this, the researcher piloted the survey questions before administering them to the students. This helped to correct any errors in the instrument before the actual study.

Finally, using more than one theoretical framework constitutes is a strength of the study. It allowed the researchers to look at the international students' experiences and plans from different lenses. Tinto's and Berry's model fully supports the findings in the present study. For example, Tinto's model asserts that academic success is achieved when an individual is integrated into campus life. Likewise, Berry's model claims that students' needs could be met in a new culture if he or she conforms to one of the norms in that culture.

Significance of the Dissertation

Relevance to the Higher Education Field of Study

Conducting this research study was relevant to higher education field of study because it adds to a growing body of research on the graduate school experiences and post-graduation plans for international doctoral students who are enrolled in science and engineering fields of study. With the dramatic increase of international student enrollments in American colleges and universities in recent years (IIE, 2011-2012), and the fact that international students have an impact on American higher education institution makes it imperative that studies such as this one are done. Researchers have shown that international students bring rich diversity and valuable perspectives to academic life (Greer, 2005; Open Doors, 2008). More studies are needed to draw attention to this growing population and to understand their challenges, in part so that educators in colleges and universities can effectively and carefully consider where to invest their resources to provide meaningful social, cultural, and academic experiences for international students on their campuses. Further findings from this study complement

and extend prior studies on social and cultural adjustment (Yeh & Inose, 2003), social integration (Tinto, 1997) and language proficiency (Andrade, 2006; Trice, 2007) in such a way as to promote rewarding academic excellence for international students.

STEM Doctoral Education

Science, technology, engineering, and mathematics (STEM) programs in the U.S. prepare a new generation of faculty and researchers in academia, as well as for a highly skilled workforce for industry and other sectors of the American economy. In addition, it generates new knowledge important for the society as a whole and to ensure U.S. competitiveness in a global economy (NAS, 2006). International Students' presence in STEM, particularly at the doctoral level, also contributes to the advancement of research in the U.S. (Hazelkorn, 2009) which may invariably help the general U.S. economy.

Another issue for consideration emanating from this study is the fact that STEM field in American universities has for some years been dominated by foreign-born students. The National Science Foundation (2010), reports that 57% of all engineering doctorates in this country were earned by foreign students. This same report indicates that 54% of all computer science degrees, and 51% of physics doctoral degrees were earned by international students. In 2009, temporary visa students earned 27% of science and engineering master's degrees, receiving 46% of those in computer sciences, 43% of those in engineering, and 36% of those in physics. The number of total foreign graduate students continued to increase through fall 2010, with all of the increase occurring in science and engineering.

Again, about 60% of all foreign graduate students in the United States in 2010 were enrolled in science and engineering fields, compared with 32% at the undergraduate level. Most of the growth in the number of foreign graduate students in

science and engineering between 2009 and 2010 occurred in engineering and computer sciences. In November 2010, students from the Asian countries of India and China constituted nearly two-thirds of the foreign science and engineering graduates in the United States. From the foregoing, it is fair to state that the United States needs both domestic and foreign-born students to fill the STEM field in order to be globally competitive.

It is also important to note that the National Science Board (2004) stated that the United States had long relied on the skills of foreign professionals, for both engineering and science. The Council on Graduate Schools admission and management also agreed with the National Science Board's (2004) argument that United States are highly dependent on foreign students for teaching and research , particularly in the sciences and in engineering, a field in which foreigners consistently comprise 50% of graduate enrollment. It is now very evident that without the participation of foreign-born students in STEM, and with the low numbers of domestic students in this field, our country will face even more challenges and manpower threat in the future.

Immigration Issues for International Students

The international students' enrollment in American universities and colleges continues to grow making the United States the largest recruiter of international students in the world. In addition, the number of international student in science, technology, engineering, and mathematics continues to grow. International students make significant contributions not only to the American higher education, but to the science and engineering fields. For example, these students engage in research activities in their colleges and universities (Poyrazli & Kavanaugh, 2006), and U.S. science, engineering and technology departments need their skills and knowledge in order to remain competitive in the global marketplace (NAFSA, 2010-2011; NAS, 2006; Wulf, 2005).

Furthermore, these students bring different aspects of their culture to campus life in American schools and help broaden cultural understanding in and out of the classroom (Bevis, 2002; Harrison, 2002).

However, since the September 11, 2001 terrorist attacks, the scrutiny of international student visa applicants to American universities has become a major focus of America's national security administration (Starobin, 2006; Wong, 2006). The formation of the Department of Homeland Security (DHS) followed by the implementation of the Student Exchange Visitor Information System (SEVIS), a web-based data collection and reporting system in 2002, are all having a major effect and constituting a drag on higher education with regards to the admission and monitoring of international students. These new policies and regulations have created difficulties for prospective genuine students who are planning to enter the United States for their post-secondary education.

Although the U.S. wants to secure the homeland by tightening national security especially after September 11 resulting in curtailing the number of visas issued to foreign students, policy makers should re-examine our immigration policies to determine whether it is benefiting or damaging the United States' ability to attract foreign students, particularly those in STEM without compromising security. Since most of the degrees earned in graduate STEM are by international students, and given the shortage of American-born citizens in the field of STEM, efforts should be made to attract international students to American schools and implement immigration policies that allow these individuals to stay in the country after graduation if they wanted and found meaningful employment

Graduate School Experiences of International Students

The findings in this study that language proficiency, social, academic, and social factors are highly important in international students' attitudes about their U.S. educational experiences indicate that institutions of higher education should pay more attention to the needs of international students if they wish to continue attracting these students to their campuses.

This study shows that:

- a) International students reported least positive social than academic and cultural experiences during their doctoral studies;
- b) International students who had higher language proficiency reported the most positive cultural, academic, and social experiences than those who had language difficulties. As shown in previous studies, Asian, non-Hispanic students and other racial/ethnic groups reported the most language concerns than White, non-Hispanic students;
- c) Younger students reported more positive cultural experiences than older students.

The study also showed that not only does language proficiency affect students' graduate experiences, but it also influenced their post graduation plans. Results showed that students with some language difficulties were more likely to report and express desires to go back to their countries after graduation rather than stay in the U.S. Those that are proficient in English were more likely to stay in U.S., find a job or continue their education. Also, students with negative cultural experiences were less likely to stay in the U.S. after graduation. On the other hand, those with positive social and cultural experiences were more likely to report that they want to stay in the U.S. after graduation than go back to their countries.

To address issues related to the adjustment of international students on the American campuses, it is important for higher education institutions to carefully develop programs to provide meaningful social, cultural, and academic experiences for international students. According to (Moore & Popadiuk, 2011), many international students experience great challenges without adequate support. Others stress the need to create positive campus learning environment that support international student adjustment to academic and social demands of campus life (Schweitzer, Morson, & Mather, 2011). Furthermore, it is a fact that international students are faced with various demands, including adjusting to different academic, social, and cultural norms. This study provides recommendations that may help international students have a successful educational experience. The following recommendations are made on the basis of the findings from this study.

Implications for Practice

Socio-Cultural Support

First, attempts should be made to develop social and cultural programs for international students who come from countries with cultures that are different from the U.S. It is safe to assume that exposing international students to different social and cultural programs or activities might be beneficial to fostering a better understanding of the cultural nuances of the host country culture. Secondly, the Office of International Education (OIE) offers a variety of programs throughout the year to international students. The principal objective of these programs is to help these students deal with their social adjustment issues and adaptation at their university. An attempt should also be made to make this information and programs readily available to international students. The OIE should make efforts to advertise its programs so that all international students can fully participate and enjoy the full benefit of the program. And since a review

of previous literature indicates that international students frequently face challenges in adjusting socially to their new environment when studying at American universities (Duru, 2008; Olivas & Li-Chi, 2006), Al-Sharideh & Goe (1998), Sam (2001) and others add that social support is therefore very important in ensuring that international students succeed in their new environment.

When international students were asked about post-graduation plan, students with positive social experience indicated that they wanted to stay in the U.S. after graduation rather than going back to their home countries. In order to give the students an opportunity to enjoy their educational experience, OIE should team up with school administrators to promote and encourage quarterly or semi-yearly inter-cultural activities on campus that would involve both U.S. and international students. International students could meet many American students and faculty at these events and might form long-lasting relationships with them. This could also afford the international students opportunities to interacting on a regular basis with American students who could help them improve their English language skills as well as their knowledge of American culture. It should be pointed out here that there might be some international students who do not feel very comfortable communicating in English, and who seldom use English outside of the University. These students could benefit from group interactive activities such as social clubs. These clubs could be organized on campus to enhance the links between international students and other students on campus, potentially focusing on informal social interactions and improving the verbal communication skills of international students. These clubs could also be a way for international students to feel socially integrated with the domestic students.

In summary, available literature suggests that social integration for doctoral students is very important as it contributes to the quality of life and enriches the

experiences of international doctoral students as well as their host students. These students lose their social support when they move to the United States and need some help. They face the challenges of making new friends and coping with the loss of social support system in their home countries (Poyrazli & Grahame, 2007). This lack of social support may invariably lead to lower academic achievement. The current study findings confirm the fact that social experiences were the most deficient among participants.

Language/Academic Support

Results of the findings in this study showed that more than half of the participants said they had language difficulties. This remarkable high number underscores the need to re-evaluate and improve on this area by higher education professionals and institutions across the country. In her study, Trice (2004) found out that socializing with American students has a direct impact on the academic achievement of international graduate students. Colleges and universities can use the findings of this study to better understand, guide and assist international students in making a successful transition to graduate school in the U.S. and in finding ways to encourage them to be involved in a variety of educational activities that will help them attain their educational goals in a positive manner. Improving adequately their ability to function in the host country language is the first and most important aspect of social and cultural integration.

One of the implications for practice suggested by this study is that there is a call for the attention of higher education administrators to help international doctoral students in engaging actively in academic activities during their doctoral education. It might be feasible to provide international students with increased supportive campus environment in helping them achieve their academic goals and successfully complete their doctoral degree.

Another implication for practice in this study is directly addressed to academic departments that have international students in their doctoral programs. Doctoral students should be encouraged to actively interact with the faculty of the academic departments, especially their academic advisors and dissertation chairperson during their dissertation stage. According to Lovitts (2008), almost half of doctoral students never complete their degree, and most of the doctoral students leave their program at the stage of writing their doctoral dissertation. Therefore, academic departments should interact more frequently with doctoral students because it could have a direct impact on the students' academic progress.

The third implication resulted from this study is related to the office of international education responsible for coordinating services for international students. The results of the study should be taken under consideration by this office in order to support international doctoral students in their transition to the higher education in the United States as well their integration within the society. Obviously, the international office has orientation sessions, support services, and events organized for international students overall. However, they should initiate programs designed specifically to help international students in doctoral programs to improve their language skills which in turn will affect academic success, as well as their cultural and social integration.

Implications for Policy

Immigration Policies

First, there should be a change in U.S. academic visa issuance policy to make our country more accessible to these students. Douglas and Edelstein (2009) also agree that the United States needs more liberal immigration policies for foreign STEM students and to make it easier to obtain H-1B visas for scientists and engineers who want to work in the U.S. On a federal level, qualified international STEM students should be granted

visas to come to the United States for their post secondary or graduate education. This notion is based on the argument advanced to stem the loss of valuable brain power via the U.S. Homeland Security policy of curtailing the issuance of visas to foreign-born international students. To this, Zhang (2011) has warned that U.S losing edge in STEM is a serious problem because “STEM fields are often considered to hold the technological underpinnings of global competitiveness and knowledge economy; STEM workforce is crucial to national and state economies” (p.390). Hope may be rising in this direction. Recently, the Department of Homeland Security (2012) announced Obama administration supports for an immigration reform and any legislative measures aimed at attracting and retaining ‘those who create jobs and boost competitiveness here in our country’.

Recruitment Policies

American higher institutions should try to recruit more international students particularly those in the STEM fields. Once they are here, efforts should be made to award financial aid in the form of scholarships or grants to foreign-born STEM students. Research indicates that one of the factors leading to the drop in the numbers of international students studying in U.S. includes among other factors, the high tuition cost of obtaining a STEM degree and economic recession, to name a few. As cited by Klein (2011), the Obama administration is aware of the “soaring tuition cost” in American higher education and has initiated the Race to the Top program in 2009 to reward states who are maintaining their higher education standard through student achievement and high retention rate (p.21). In line with the administration’s policy, Martha Kanter, the Under secretary, U.S. Department of Education, stressed that if immediate actions are not taken to eradicate this problem, higher education will be unaffordable for many students. She

also contends that we will continue to lose a large number of international students who pay even higher tuition than domestic students.

Retention Policies

Another recommendation is to find ways to retain international STEM students after they graduate so they can contribute to American workforce. I tend to agree with President Obama's views that U.S. should staple green cards to the certificates of foreign-born graduates in STEM fields (Department of Homeland Security, January, 2012). Supporting the above views, NAFSA (2010-2011) issued a report recommending that STEM students should have improved access to green card. According to this report, it would create the opportunity for STEM graduates to apply directly for and be upgraded to green card upon graduation without necessarily going through the bottleneck of queuing for temporal H-1B non-immigrant visa. Furthermore, the report revealed that many international students want to begin the process of obtaining a green card right after graduation and since U.S. would benefit from these students staying in the United States, the process should be accelerated.

STEM Policies

Domestically, while continuing to fine tune policies to recruit international students to fill the gap in these shortages, efforts should be made by the government to increase the numbers of American-born students in STEM. One of the steps is to look into the curriculum and who is teaching it. Hiring knowledgeable teachers who are grounded in teaching STEM subjects and giving them incentives to stay will be highly recommended. It is commendable that the Obama's administration has authorized for recruitment of 100,000 STEM teachers over the next decade. It is necessary that this recommendation should be translated into action. Also it could be beneficial for the United States to recruit some of these STEM teachers from the pool of international

students who graduate in STEM fields. Most importantly, U.S. must try to review the STEM curricula utilized by countries like China, India, and South Korea that are excelling in offering high school students and undergraduate students a strong STEM foundation with the purpose of adopting some of their effective learning and teaching methods. We should acknowledge that many international students who are successful in STEM fields in the United States have received their K-12 education in countries whose high school students are systemically performing well in international competitions. Therefore, many of our international STEM students are usually knowledgeable of successful curricula, teaching and learning styles, and classroom practices nurturing high performance. Also, the United States government should find a way to awaken the enthusiasm of American students in the field of STEM.

Very important, the current trend regarding how we handle international student issues in our country must be reviewed in order for U.S. to regain and remain globally competitive in STEM. The United States has lost its edge in attracting and enrolling international students in U.S. universities. This is particularly troubling in science and engineering at the graduate school level and carries implications for America's economy, its technological leadership and its role in the world. Obstacles still remain that prevent the country from significantly increasing the enrollment of international students at U.S. universities. Policy review and improvements can be made in several areas that will help ensure American leadership in international education to ensure strong scientific and technological foundation for the nation.

Implications for Further Studies

This quantitative study was conducted to help fill the gap in the limited research on international students, particularly international students who are enrolled in the

science and engineering doctoral program. Due to paucity of such studies, and based on the findings of the present study, future research can expound on the following areas.

First, the present study could have been strengthened by including international doctoral students in different academic disciplines or more than one higher education institution in order to expand the information about their educational experiences. Therefore, it would be useful to conduct comparative studies that can look at the graduate school experiences and post-graduation plans of international doctoral students by academic discipline and institution. This is mainly because doctoral education is experienced differently within and among different disciplines (Gardner, 2009). Although it is likely that many of the experiences these study participants described might be same as of other international students at different settings, it is worth exploring these issues from a comparative perspective.

Secondly, based on the literature review, most studies on international students and their educational experiences are quantitative studies. More qualitative studies are needed to allow researchers to hear the voices of international students about their social, academic, cultural, and language challenges in a new environment. Understanding these challenges would help universities in designing strategies to help international students improve their English language skills and have a successful school experience.

Most of the findings in this study center not only around social and cultural issues, but also on English language proficiency. The study findings showed that the responses to the questions on graduate school experiences reveal that participants reported negative social and cultural experiences in their academic journey. McClure (2007) explains that international students are often lonely in their new environment. He asserts that such loneliness emanates from the lack of familiar friends and social

network. Other research emphasizes that developing social network with American students helps international students make successful social adjustment (Lee, 2008). Therefore, future research is needed to find out how interacting with American students can help promote positive social and cultural experience among international students. Furthermore, studying international doctoral students' socialization patterns with Americans based on their countries of origin and recommending strategies to encourage international doctoral students to interact with Americans would be helpful for the students' social as well as cultural well-being during their doctoral study.

The study also found that having strong English language skills was helpful for positive cultural, social and academic experiences. Lack of language proficiency was found to be a barrier for the adjustment of international students in this study, particularly Asian, non-Hispanic doctoral student. In addition to the above discussion, English language difficulties were found in this study as a key factor in students' decisions about post-graduation plans. Results revealed that students who had some language difficulties were more likely to plan going back to their countries rather than staying in the United States upon the completion of their program. Due to the dearth of research on international students with regards to post-graduation plans (Finn, 2005), it is imperative that future research should also continue to examine the relationship between language skills and post-graduation plans. Although this study did not find any direct negative effect of language on academic achievement, many studies have shown that lack of English proficiency can lead to stressful academic experience (Andrade, 2006; Yeh & Inose, 2003). It is therefore important that future research should also continue to examine various issues related to the international students' language skills. More studies should also continue to investigate different factors, other than English language proficiency that

could hinder with the learning of the Asian students' population who have dominated the field of science and engineering.

Conclusion

Previous research on international students mainly focused on undergraduate students and on issues such as overall adjustment, language difficulties, culture shock and other issues related to their social and academic life in United States. Many researchers (Lee & Gardner, 2010; Moffett, 2006), warn there is paucity of research information when it comes to international students in the doctoral program. The findings from this dissertation make a significant contribution to literature on international students as it examined graduate school experiences and post-graduation plans of international doctoral students who are enrolled in science and engineering at a public university. Moreover, studies like this one can provide insights to universities and colleges about recruiting and retaining international students.

Therefore, the academic departments, office of international education, and the university as a whole should use the results of this study to improve doctoral experiences for all students. Educational institutions, especially the public university that was used for this study should create better opportunities to promote more interactions among international and domestic students, and as well as student-faculty interaction. Research has shown that this is a good way to build persistence, sustain interest and reduce the incidence of doctoral attrition (Nettles and Millett, 2006).

In general, Tinto's theory is fully validated in this study. Social integration, academic success, and cultural factors all contributed to students' graduate school experiences and post-graduation plans. Specifically, negative cultural experience resulted in students' decision to leave the U.S. after graduation while positive academic and social experience was influential in the student's decision to stay. Finally, according

to Tinto (1993) students must be fully adjusted socially and academically to be able to have a positive learning experience.

The study results were also consistent with Berry's Acculturation model which suggested that students who are in a new culture experience adjustment problems due to their unfamiliarity to the norms of their host culture. As evidenced from the findings of this study, students with language difficulties reported more negative cultural experience than those with no language difficulties. Clearly, doctoral students that participated in this study expressed that they had some social, academic and cultural challenges. Language proficiency, as supported by literature, has been shown to influence students' social, academic and cultural adjustment, with cultural experiences being the most affected of all three experiences. As Berry pointed out, international students face acculturative stress as they struggle through life adjustments in their new culture and therefore, are faced with the struggles of coping with the new language and situation they find themselves in. Just like Tinto's theory discussed previously, Berry's acculturation model was an appropriate model for this research.

Appendix A
Definition of Key Terms

Adjustment: students' academic and language skills factor.

Academic integration: involvement with faculty and classroom activities (Tinto, 1975)

Acculturation: the process of adapting to a new culture, including the behavior and other changes that take place during the process

Graduate students: students who continue their education after obtaining a bachelor's degree.

H-1B non-immigrant visa The H-1B visa is a non-immigrant classification used for a foreign worker who is employed temporarily in a specialty occupation.

International Students: students who temporarily stay in the United States to accomplish their educational goals (Sakurako, 2000).

Permanent Resident: Permanent Resident, according to U.S. Citizenship and Immigration Services (UCIS) is someone who has been granted authorization to live and work in the United States on a permanent basis. As proof of that status, U.S. Citizenship and Immigration Services (USCIS) grants a person a permanent resident card, commonly called a "Green Card."

Social integration: the level of participation in extracurricular activities as well as forming relationships with peers (Tinto, 1975).

Appendix B
IRB Approval

Institutional Review Board

Notification of Exemption

September 26, 2013

Dorothy Ugwu

Dr. Maria Trache

Educational Leadership & Policy Studies 19575

Protocol Number: 2013-0831

Protocol Title: Graduate School Experiences and Post-Graduation Plans of International Science and Engineering Doctoral Students at a Public University

EXEMPTION DETERMINATION

The UT Arlington Institutional Review Board (IRB) Chair, or designee, has reviewed the above referenced study and found that it qualified for exemption under the federal guidelines for the protection of human subjects as referenced at Title 45CFR Part 46.101(b)(2)

(2)Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless:(i) information obtained is recorded in such a manner that human subjects can be identified, either directly or through identifiers linked to the subject; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation.

You are therefore authorized to begin the research as of September 26, 2013.

Pursuant to Title 45 CFR 46.103(b)(4)(iii), investigators are required to, "promptly report to the IRB any proposed changes in the research activity, and to ensure that such changes in approved research, during the period for which IRB approval has already been given, are not initiated without prior IRB review and approval except when necessary to eliminate apparent immediate hazards to the subject." Please be advised that as the principal investigator, you are

required to report local adverse (unanticipated) events to the Office of Research Administration; Regulatory Services within 24 hours of the occurrence or upon acknowledgement of the occurrence. All investigators and key personnel identified in the protocol must have documented Human Subject Protection (HSP) Training on file with this office. Completion certificates are valid for 2 years from completion date.

The UTA Office of Research Administration; Regulatory Services appreciates your continuing commitment to the protection of human subjects in research. Should you have questions, or need to report completion of study procedures, please contact Robin Dickey at 817-272-9329 or robind@uta.edu. You may also contact Regulatory Services at 817-272-3723 or regulatoryservices@uta.edu

Appendix C
Recruitment Letter

Dear Doctoral Students:

Thank you for agreeing to participate in the International Graduate Student Survey. Participants in this study are doctoral students enrolled in the science and engineering program at the Richman University (RU).

This study is aimed at exploring the process of your graduate school experiences and post graduation plans. The findings of this study also aim at informing educational practitioners about your experience related to science and engineering at the graduate level. Further, your participation in this survey helps us learn more about your graduate school experience and goals.

Survey findings will help faculty, staff and administration at the Office of International Education provide better career education services to international students during their time at RU. The survey results will be used by Dorothy Ugwu as part of her Doctoral in Educational Policy and Leadership Studies dissertation. The survey should take about 20-25 minutes to complete. Please read the instructions for each question carefully and indicate your response by checking the appropriate box(s). When written responses are required, please make sure that your answer is easy to read.

Your responses in this survey are strictly confidential. You will not be linked to the data by your name or any other identifiable item. The survey contains no information that would lead to the identification of individuals. While your name, email and address will be used in order to complete the random prize draw, this information will not be linked to the survey data/responses. The survey data is stored on a secure Survey Monkey server.

Your participation in this survey is entirely voluntary. You can choose to stop the survey at any time before it is complete.

Please make sure that you complete all relevant sections.

Thanking you in advance,

Dorothy Ugwu, Doctoral Candidate

The University of Texas in Arlington, College of Education and Health Professions Department
of Educational Leadership and Policy Studies
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Appendix D

Online Consent to Participation Form

Online Consent to Participate in Research

Title: Graduate School Experiences and Post-Graduation Plans of International Science and Engineering Doctoral Students at a Public Research University

Principal Investigator:

Dorothy Ugwu

College of Education and Health Profession

Educational Leadership and Policy Studies Department

Faculty Advisor

Dr. Maria Trache

College of Education and Health Profession

Educational Leadership and Policy Studies Department

Introduction:

I am conducting a research study for the purposes of examining the relationship between post-graduation plans and graduate school experiences of doctoral students enrolled in the science and engineering (S&E) programs at the Richman University. As a student who is enrolled in the science or engineering field, I invite you to participate in this study.

Purpose of Research: The objective of this study is to provide higher education institutions that have international graduate student populations, as well as to those universities that wish to admit a larger number of international graduate students with a better understanding of the factors that may influence international students' graduate school experience and post-graduation plans. Likewise, if educational practitioners within an academic program fully understand the major factors influencing students' academic success, more can be done to help retain students in higher education that may have otherwise chosen to depart upon graduation.

The research has been approved by the Institutional Review Board.

Absolutely no identifying information, such as name, address, telephone number, or email address will be transmitted when participants submit a completed survey. Unless you choose to provide your contact information for the drawing, you will not be contacted in any way by the researcher or by anyone else.

Description of Research: You will complete an anonymous survey examining the relationship between post-graduation plans and graduate school experiences of doctoral international science and engineering students.

Specific Procedures to be used: You will complete the anonymous survey, which will be returned to the researcher via an online link.

Duration of Participation: The survey will take you about 20-25 minutes to complete. That is the extent of your participation.

Benefits to the Individual: Participants will be helping the researcher, and institutions of higher education in better understanding the factors that may influence international students' graduate school experience and post-graduation plans.

Risks to the Individual: There is a chance of a breach of confidentiality in regards to participation in this study. There is a potential risk of loss of confidentiality in all email, downloading and internet transactions. However, no identifiable information will be collected with the measures of interest. Identifying information will only be collected in a separate email for the purposes of the incentive. The website containing the online survey will be housed on a secure server accessed only by the researcher through a protected user name and password. You may withdraw from the study with no penalty and you do not have to respond to a particular question that causes discomfort. The researcher will try to prevent any problem that could happen because of this research. You should let the researcher know at once if there is a problem and I will help you. Your participation in this study is self selected and voluntary.

Confidentiality: Your answers will be completely confidential, with the only person having access to them being the researcher. Confidentiality will be protected to the extent that is

allowed by law. The website containing the study survey will be housed on a secure server accessed only by the researcher through a protected user name and password. When you submit a completed questionnaire to the researcher, identifying information, including names, addresses E-mail addresses, web routing numbers, etc., will not be included on the form, and will not be transmitted with the form.

All participants who complete the survey will have the opportunity to enter a grand prize drawing for a Wal-Mart gift certificate in the amount of \$50.00. Three winners will be chosen at random. If you would like to be included in a drawing for an incentive, you will be asked to send a separate e-mail to me with your name, E-mail, address, and a telephone number indicating your desire to be in the drawing.

The survey will inform you before giving this information that this identifying information is given only for the purposes of the incentive drawing and will not be stored with the original survey data and that upon completion of the study this identifying information will be permanently deleted.

Voluntary Nature of Participation: You do not have to participate in this research project. If you agree to participate, your participation may be withdrawn at any time without penalty by not completing the questionnaire.

Contact for Questions: If you have any questions about this research project, you can contact me at dorothy.ugwu@mavs.uta.edu or 972-822-4412. You can also contact my faculty advisor at mtrache@uta.edu or 817-272-0991. Any questions you may have about your rights as a research participant may be directed to the Office of Research Administration; Regulatory Services at 817-272-2105 or regulatoryservices@uta.edu. Clicking accept below constitutes your informed consent to act as a participant in this research.

Appendix E

Survey

Graduate School Experiences and Post- Graduation Plans of International Science and Engineering Doctoral Students

Section A: Background

Directions: Questions 1 to 27 ask you about individual background (e.g., age, gender, country of birth, race/ethnicity, and language proficiency)

Academic history (e.g., current enrollment, years of study and individual goals)

Financing higher education (e.g., financial sponsorship)

Family background (e.g., parental education)

1. What is your age?

- 20-25
- 26-30
- 31-35
- 36-40
- 41-45
- 46-50
- Over 50

2. What is your sex?

- Male
- Female

3. What is your country of origin?

4. What is your racial origin?

- a) American Indian/ Alaskan Native, non-Hispanic
- b) Asian, non-Hispanic
- c) Black/ African American, non-Hispanic
- d) Black/ African

- e) Hispanic or Latino
- f) Native Hawaiian or Pacific Islander, non-Hispanic
- g) White, non-Hispanics
- h) Other, specify _____

5. What is the highest level of education completed by your mother? (Choose one).

- Less than high school
- High school diploma
- Some college
- Associate's degree
- Some University studies
- Bachelor's degree
- Master's degree
- Doctoral degree
- Professional degree (M.D., JD)
- Professional degree (M.D., PhD)
- Professional degree (JD, PhD.)
- Do not Know

6. What is the highest level of education completed by your father? (Choose one).

- Less than high school
- High school diploma
- Some college
- Associate's degree
- Some University studies
- Bachelor's degree
- Master's degree
- Doctoral degree

- Professional degree (M.D., JD)
- Professional degree (M.D., PhD)
- Professional degree (JD, PhD.)
- Do not know

7. Have your parents obtained any degrees in the United States?

- Yes, both parents
- Yes, one parent
- No
- None

8. Have your parents pursued careers in Science or Engineering?

- Yes, both parents
- Yes, one parent
- None
- Do not Know

9. What is your current program area of study at UTA?

- Doctoral degree in Science
- Doctoral degree in Engineering

10. In what year did you first start this program at UTA?

- a. Before 2005
- b. 2005
- c. 2006
- d. 2007
- e. 2008
- f. 2009
- g. 2010
- h. 2011

- i. 2012
- j. 2013
- k. Do not know

11. How many years have you been in the current UTA program?

- a. 1
- b. 2
- c. 3
- d. 4
- e. 5
- f. 5 or more years

12. Have you attended another American university before UTA?

- Yes
- No

13. Have you attended UTA for another program prior to current enrollment?

- Yes
- No

14. Did you start the doctoral degree at UTA or transfer from another American university?

- Yes, I started at UTA
- No, I transferred from another American university
- No, I transferred from another foreign university

15. What year do you plan to complete your current doctoral studies at UTA?

- a. 2013
- b. 2014
- c. 2015
- d. 2015 or later
- e. Do not know

16. Which of these factors influenced you to enroll in a doctoral program in science or engineering? (Check all that apply).

- Family
- Friends
- Personal interest in math and science

College/University teacher

- High school teacher
- Job Opportunities
- Career Growth
- Higher Paying Job
- Career opportunities
- Other (Please specify) _____

17. Who is financing your current UTA graduate education? (Check all that apply).

- Parents or family
- Personal savings
- Scholarship or grants received from U.S. federal sources
- Scholarship or grants received from UTA
- Country of birth's government sponsorship
- Other sponsorship (not from U.S. or country of birth government)
- Employment (e.g., on campus or off campus)
- Loans
- Do not Know

18. How well can you speak English?

- Poorly
- Fairly Well
- Well

Very Well

19. How well can you read English?

Poorly

Fairly Well

Well

Very well

20. How well can you write English?

Poorly

Fairly well

Well

Very well

21. How did you learn most of your English?

	Yes	No	Don't Know
From family and friends	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Language training classes (e.g., ESL classes, English classes at school or community center)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Private tutor?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Self study (e.g., books, tapes, computer software)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Schooling was in English?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
From media (e.g., radio, movies, TV, newspapers)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Everyday interactions?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Other _____

22. How important is it for you to learn or improve your English? Would you say:

- Very important
- Important
- Not very important
- Not important at all
- Don't know

23. Since you came to United States, do you feel that you have had opportunities to learn or improve your English?

- Yes
- No
- Don't know

24. Does English proficiency hinder your academic performance in the university?

- Greatly
- Quite
- Moderately
- Slightly
- Not at all

25. Do you have difficulty communicating with Americans (students or professors)?

- Very Often
- Often
- Sometimes
- Rarely

Never

26. Do you have any comments or experience about the language barrier that you want to share?

Section B: UTA Experiences

Directions: Questions 27-29 ask you about your academic, social and cultural experiences while attending the current doctoral program at UTA

27. To what extent do you agree with the following statements?

	Strongly Agree 5	Agree 4	Neither Agree or Disagree 3	Disagree 2	Strongly Disagree 1	N/A 0
My department has tried to make my adjustment to graduate school as easy as possible.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The faculty members in my engineering or science department are available outside class.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I feel that most faculty members in my engineering or science department are supportive.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
My advisor is helpful in assisting me to reach my academic goals.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

My dissertation committee is helpful in assisting me to reach my academic goals.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I look forward to taking engineering or science classes.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am actively involved during lab sessions.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I do not feel isolated in my engineering or science classes.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I plan to be one of the top students in my classes.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am confident that I will be able to excel academically in the current doctoral program.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I enjoy learning topics related to science or engineering.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I feel that the current doctoral program helps me attain my academic goals.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I feel that the current doctoral program helps me attain my career goals.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

28. To what extent do you agree with the following statements?

	Strongly Agree	Agree	Neither Agree or Disagree	Disagree	Strongly Disagree	N/A
	5	4	3	2	1	0

I am comfortable interacting with students from other countries.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am comfortable interacting with American students.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am good at making friends with other students.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am involved in campus social activities.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am not interested to have much contact with students from other countries on campus.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am not interested to have much contact with American students on campus.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I enjoy working with other students during classes and lab sessions.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I would like to interact more academically with other students.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I would like to work independently during classes and lab sessions.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

	Strongly Agree 5	Agree 4	Neither Agree or Disagree 3	Disagree 2	Strongly Disagree 1	N/A 0
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I have participated in the International office's Employment Seminar Program.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I have participated in the International office's Global Grounds / International Coffee Hour Program.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I have participated in the International office's Education Week Program.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I have participated in the International office's Peer Advisor Program.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I have participated in the International office's International Week Program.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I have participated in the International Office's Link Friendly Program.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I have participated in the Residence hall activities.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I have participated in the Community service activities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I have participated in the Social events such as movies, concerts, dance program, plays, athletic programs.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I have participated in the Events sponsored by fraternity or sorority	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I have participated in the Academic Department Clubs.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I have participated in the Political or social action	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

groups.						
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29. To what extent do you agree with the following statements?

	Strongly Agree 5	Agree 4	Neither Agree or Disagree 3	Disagree 2	Strongly Disagree 1	N/A 0
Students tell me that I am good at understanding how people from different cultures behave.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am able to take on various roles as appropriate in different cultural settings.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am confident that I can take care of myself in a completely new culture.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I often get out of my comfort zone to better understand people from other cultures.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I see myself as a global citizen.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I enjoy interacting with individuals from other cultures.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I enjoy when my friends from other cultures	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

teach me about their culture.						
I often involve people from many cultural backgrounds in my personal life.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I understand that there are cultural differences in the world.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am open to people who live very different from my own life style.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am accepting of people with different religious and spiritual beliefs.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I understand how different cultures of this world interact socially.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I know who I am as a person.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I can explain my personal values to people who are different from me.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I believe that my university community honors diversity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I feel threatened around people from cultural backgrounds very different from my own.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I feel threatened emotionally when presented with multiple perspectives.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section C: Plans after graduation

Directions: *Questions 30-34 ask you about your plans after graduation and your career preparation while completing your doctoral education.*

30. Based on your graduate school experiences at UTA, what would you consider doing after you graduate? (Choose only one that applies to you)

- Stay in the United States and get a job
- Stay in the United States and pursue more education
- Work temporarily in the United States before going back to your country
- Go back to your country
- Find a job anywhere in the world
- Not sure

31. If there is a pathway to citizenship, would you be interested?

- Yes
- No

32. Have you been able to participate at UTA in any of the following professional activities that will help you get an engineering or science job after graduation?

	Yes, in engineering or science related job	Yes, in a job unrelated to engineering or science	No
Research Assistantship	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Graduate Assistantship	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Teaching Assistantship	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Work on- campus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Internship	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Optional Practical Training	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Curriculum Practical Training	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Work off-campus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

33. After you graduate, how likely is it that you will:

	Definitely Won't	Probably Won't	Not Sure	Probably Will	Definitely Will
Find an academic job in engineering or science	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Find a research job in engineering or science	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Find an engineering or science related job in industry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Find an engineering or science related job in a government organization	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Find an engineering or science related job in a non-profit organization	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Be self-employed in engineering or science field	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Work outside engineering or science field	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Other plans (please explain)

34. Do you have any suggestions on how any of the survey questions can be improved?
35. How long did it take you to answer the survey?
36. Please indicate whether or not you would like to be entered in a drawing to receive a \$50 gift card to Wal-Mart.

Yes

No

If you answered yes above, please send me a separate e-mail to dorothy.ugwu@uta.edu and provide your name, email address, and mailing address in order to receive the gift card if your name is drawn.

Please click submit below to complete the survey. Thank you for your participation.

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Biographical Information

Since obtaining a Bachelor's degree in Comprehensive Business Administration and a Master's of Arts degree in Communication Studies from Edinboro University of Pennsylvania, Dorothy Ugwu has spent all her years as an Educator in Elementary School. Her love for education and her cumulative experiences over the past several years led her to pursue her doctoral program at the University of Texas at Arlington where she is obtaining a degree in Educational Leadership and Policy Studies. She has always desired to research on how best international students can learn in America and also on the several factors that could prevent them from facing adjustment difficulties. She has spent some time in her career attending educational seminars and conferences, and has presented her scholarly work in those conferences. Her future plan is to remain in the education field. She hopes to gain an employment as a college professor or a director in the special education department where she is currently a lead inclusion teacher.