Withdrawal and Non-Passing Grades in UPRM Pre-calculus I:
What's Language got to do with it?

by

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Abstract

The focus of this study is to examine if the English language influences withdrawal or failure rates in Pre-Calculus I at the University of Puerto Rico in Mayaguez. Using data from the Office of Research and Institutional Planning, chi-square tests found a relationships between English grades and grades received in MATE 3171. A questionnaire, using Likert scales, examined student perception of the English learned in high school and its usefulness for understanding course materials in pre-calculus and their college classes at UPRM. The questionnaire was answered by 270 participants enrolled in MATE 3171 during the 2013 spring semester. Of these, forty two first-year students were repeating the course and the data shows that although 57% had studied in bilingual schools, 24% indicated the English they learned was not useful in MATE 3171. The findings suggest further studies should focus on language for the successful completion of non-English courses.

Keywords: withdrawals, retention, dropout, retention and institutional factors

Resumen

El objetivo de este estudio es examinar si el inglés influencia las bajas o tasas de fracaso en Pre-Cálculo I en la Universidad de Puerto Rico en Mayagüez. Utilizando datos de la Oficina de Investigación y Planificación Institucional, pruebas chi-cuadrado establecieron una relación entre las notas recibidas en inglés y en Precalculo. Un cuestionario utilizando escalas Likert, examinaron la percepción de estudiantes sobre inglés aprendido en la escuela secundaria y su utilidad para la comprensión de materiales en precalculo y sus clases de la universidad en UPRM. Participaron 270 estudiantes matriculados en Precalculo durante el segundo semestre de 2013. De esos, cuarenta y dos estudiantes de primer año estaban repitiendo el curso y los datos muestran que aunque el 57 por ciento había estudiado en escuelas bilingües, el 24 por ciento percibe que el inglés que aprendieron no era útil en Precalculo. Los hallazgos sugieren realizar nuevos estudios enfocados en el inglés para los cursos que no son en inglés.

Palabras clave: retiros, retención, deserción escolar, retención y factores institucionales

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"And then, after waiting so long, one day like any other, I decided to triumph…I decided not to wait for the opportunities, but rather to seek them for myself, I decided to see every problem as an opportunity to find a solution, I decided to look at every desert as an opportunity to find an oasis, I decided to look at every night as a mystery to be resolved, I decided to look at every day as a new opportunity to be happy.

That day, I discovered my only rival was not more than my own weaknesses and in them, are the only and best form of progressing; that day, I stopped the fear of losing and began to fear not winning, I discovered I was not the best and probably never was, I stopped caring who won and who lost; now I simply care about knowing myself better than I did yesterday. I learned the hard part is not getting to the top, but rather to stop climbing. I learned the greatest triumph I can have is the right to call someone a friend.

I discovered love is more than a simple state of being in love, "Love is a philosophy of life." That day, I stopped being the reflection of my few past triumphs and began instead, to become my own faint light of this present time; I learned that nothing serves being light if you are not going to illuminate the path of others.

On that day, I decided to change so many things…that day, I learned dreams exist only to make them a reality, from that day forward I no longer sleep to rest…now I simply sleep in order to dream" (Anonymous).

First and above all, I thank God for the unconditional love He has bestowed upon me always. He has blessed me with an unending faith which has seen me through the most difficult moments in my life along with health, strength and most of all, the courage I have needed to be where I am today. The verse I cite speaks of my views on life, but none would have been

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travel, and to see the woman you have become inspires me to be a better person. "*Come----_*

hasta el fin"; we laughingly say this statement back and forth throughout all of our achievements,

but in reality it has become our deepest connection and our message of triumph through

adversity. Two older women who strive to improve and redo their lives time and time again

because the challenge presents itself and both want to reach that goal; I will always be as proud

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I could narrow my population. I am grateful for the importance you gave my project. You

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Dedication

This research paper is dedicated to the memory of Stephen Castro, my brother from another mother, my friend. Thank you Stevie, as my sons lovingly called you, for sharing your journey with me. I am privileged to have called you "Friend." You epitomize courage, kindness, compassion and strength in times of diversity. Our spiritual and emotional link had a great deal to do with our outlook on life. We will always be kindred spirits because we chose living and loving. You were a great husband, a loving father, a great granddad, a terrific friend, and more importantly, an honorable man. You will always be in my heart. Darwin said, "A man's friendships are one of the best measures of his worth." You my dear friend, were rich beyond your wildest dreams and all of us are richer for having known you.

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Table of Acronyms

CALLA	Cognitive Academic Language Learning Approach
CEEB	College Entrance Examination Board
CPSHI	Committee for the Protection of Human Beings in the Investigation
D or F	Non-passing grade
ESLAT	English as a Second Language Achievement Test
INGL	English
IRB	Institutional Review Board
MAEE	Master of Arts in English Education
MATE	Mathematics
MATE 3171	Pre-Calculus I
NAEP	National Assessment of Educational Progress
NCES	National Center for Educational Statistics
OIIP	Office of Research and Institutional Planning
UPR	University of Puerto Rico
UPRM	University of Puerto Rico in Mayaguez
W	Withdrawal

Chapter One: Introduction

Tinto's Interactionalist theory calls for the development of institutional educational missions which should be implemented in order to create and employ a retention policy which establishes specific commitments to students entering the university. This was a concern at a meeting of faculty members from *Comité ad-hoc del Senado Académico para el Estudio de las Bajas Parciales en el RUM* (2011), due to students' high withdrawal levels as evidenced from data from University of Puerto Rico at Mayaguez's Office of Research and Institutional Planning (in Spanish, OIIP); it indicates a trend in high withdrawals and non-passing grades, particularly, but not exclusively in Pre-calculus I MATE 3171. This study, therefore, explores to what extent language is a key component for withdrawal levels and non-passing grades in this course. Given that the course textbooks and/or materials provided and in many cases are offered in English and some professors present their class in English may hinder students' understanding of the topic, thus promoting withdrawal from the course especially students enrolled at UPRM Basic English track (INGL 3101-3102).

Dropout Rates in the United States

During my teacher certification studies, I researched high school student dropout rates in the United States, focusing my attention on the Spanish-speaking community. Having been raised in a low-income New York City neighborhood where graduating from high school was an infrequent event, it was important for me to study this issue, especially regarding Hispanics in the United States. Consequently, this concern led me to study the topic of dropout rates during my Master of Arts in English Education studies (MAEE) at UPRM, where I continued to focus on Hispanic students in order to examine possible correlations between language competency and retention rates in both high school and college level students. Data from the National Center

for Education Statistics (NCES) and the U.S. Census Bureau, Jones and Bou-Waked (2007) concur and indicate Hispanics are dropping out from high school at twice the rate of African American students and three times the number of white students. Their study concluded, "…the dropout rate for young adult Hispanics from 16 to 19 years old, is more than double the comparable dropout rate of blacks (10.4%) and non-Hispanics (6%)" (p. 2). Current data obtained from National Center for Education Statistics (2013) indicate for 2011, the dropout rates for Whites (5%) continues to be lower than the dropout rates for Blacks (7%) and (14%) for Hispanics (The Condition of Education, 2013) . This data continues to show a disparity among the dropout rates for Hispanics, as compared to White and Black students.

Jones and Bou-Waked (2007) further examined how language proficiency contributes to the high dropout rate, especially, but not exclusively, for immigrant students. Their research found an estimated 59% of Hispanics who did not speak English well, were dropouts. Moreover, only 16% of Hispanic youths who spoke English well were dropouts, while 13% of students who only spoke English at home dropped out in 2000. Surprisingly enough, Jones and Bou-Waked conclude even though second generation students are proficient in English and after accounting for language and immigration factors, the dropout rate of English-proficient Hispanics is still higher than other ethnic groups. Additionally, in an interview published by The Heartland Institute in February, 2008, Jones affirms, "I think we can safely assume that language barriers are a big factor… If you're in a class but can't read the homework or comprehend the teachers and students, then it's hard to concentrate on learning the material" (E. Flowers, personal communication, February 1, 2008). Statistics such as these are very disturbing since as the Hispanic population increases in the United States, regardless of being native-born or immigrants; the percentages demonstrate a continuing increase in the dropout rate for this

community and this is a problem which requires further investigation. If we compare dropouts

rates in Puerto Rico, Calderon, et al (2009) indicate 19% of Puerto Ricans ages 18 to 24 have

less than high school or equivalent education. Data provided from Puerto Rico's 2010 Census

report dropout rate from ages 16-17 are 7.0% and for ages 18 to 21 years the rate is 2.7%.

College–level Enrollment and Hispanics in U.S. Colleges

While carrying out research on this concern during my graduate-level courses, data

indicates an increase in Latinos college enrollment in the United States. Indeed, based on data

collected by the U.S. Census Bureau from 1997 to 2000, Fry (2002) reports how "…by some

measures, a greater share of Latinos are attending college classes than non-Hispanic whites" (p.

v). However, this study sustains that although Hispanics (ages 18-24) have increased their

college enrollment to 35%; a 200 percent growth in the last 25 years, just over 10% of the

Hispanics in the country now have a college education less than the national average for adults.

This percentage is compared to 46% of whites and 40% of African Americans. Although Fry's

(2002) study demonstrates how an interest in higher education is expressed by Hispanics, there

seems to be a gap between the number of students who enroll in higher education and the

number who actually manage to complete their degrees.

Fry (2004) continues to examine the disparity among Latin and white students entering

college and their respective completion rate. This study demonstrates how 81% of white students

complete a bachelor's degree, in contrast to 57% of Latinos. Fry (2004) sustains college selection

has a huge impact on the completion rate, because Latinos, whether academically prepared or

not, usually choose a non-selective or open-door college. For those students who choose a

prestigious institution, their college experience becomes less favorable than those of many white

students due to economic hardships which prevent them from being able to live on campus.

Fry and Taylor (2013) indicate 69% of Hispanic high school graduates in the class of 2012 enrolled in college that fall, two percentage points higher than the rate (67%) of white students (p 4). Despite the rise in college enrollment, Hispanic college students are still less likely than whites to enroll in a four-year college (56% vs. 72%); they are less likely to attend a selective college, and less likely to be enrolled in college full time, and less likely to complete a bachelor's degree (p. 5). If we compare college completeness to Puerto Rico, Calderon, et al (2009) also include dropout rates for students between 22 to 24 years old (considered college level) reporting the rate at 9.1% for young adults.

Although language was not a variable examined in these studies, it is evident there exists a disparity as to the college completion rate among Hispanic students in both the United States which requires further study.

English Language Proficiency and Academic Performance at UPRM

Higher education in Puerto Rico has experienced a phenomenal increase in college enrollment. Collins, Bosworth and Soto-Class (2006), claim it has increased from 24,532 in 1960 to the current enrollment of 250,000 students. This has resulted in an increase in the number of students who have attained a college degree. In 1960, 3.5% of people 25 years or older had a college degree; while at present 20.2 % have a college degree, a number that is below the 28% for the United States. A study provided by UPRM *(*Puerto Rico at the Top in Education Investment as a Percentage of its GNP and Increasing the Education Level of its Citizens, n.d.) states Puerto Rico has a higher percentage of students enrolled in higher education in the 18 to 24 age group than the United States, with a total of 34.4% for Puerto Rico versus 33.9% for the U.S. Consequently, my previous research on the impact of language proficiency and its effect on

retention rates for Hispanics in higher education in the United States prompted the study of a

relationship between English language proficiency and college performance and/or retention at

this institution.

In order to initiate this study, the enrollment standards for students entering UPRM,

specifically their English course placement, was considered. This is determined according to

their English proficiency levels as determined by the scores obtained in their College Board

exam. Based on their aptitude scores in English, they are placed in a particular course sequence

which is designed to meet the needs of the students who enroll, as stipulated by the UPRM

Student Catalogue (2013-2014):

> • Students who score below 570 on the ESLAT (English as a Second Language
>
> Achievement Test) will be placed in the basic sequence of courses: INGL 3101, INGL
>
> 3102, INGL 3201, and INGL 3202.
>
> • The intermediate sequence of courses, starting with INGL 3103 and INGL 3104, is for
>
> entering students at UPR/Mayagüez who have scored above 570 on the ESLAT (English
>
> as a Second Language Achievement Test), but who have either not taken the Advanced
>
> Level Test in English or did not qualify for advanced placement in the Honors Program
>
> of the English Department by obtaining a score of 4 or 5 on that test. Students with a
>
> score of 3 on the Advanced Level Test will be placed in INGL 3103. Students who
>
> successfully pass INGL 3103 and INGL 3104 must take six more credit-hours in English
>
> Department courses in order to satisfy the university requirement in English (p. 163).

Language Proficiency and its Effect on Non-English Courses

In order to demonstrate the importance of looking into a possible relationship between

language proficiency and how it affects non-English courses, it is essential to present the actual

number of students who enter English Department courses. Tables 1 through 3 offer an outline of

data provided by Dr. Carroll on entry level statistics, from first semester of 2010 through second

semester of 2012 which indicate the total number of students enrolled in Basic through Advanced

English level courses (K. Carroll, personal communication, February 7, 2013).

Table 1. *Student Enrollment for English Courses offered from 2010 to 2011*

English Courses	Year of enrollment 2010-2011	
	First Semester	Second Semester
Pre-Basic INGL 0066	284	0
Basic (INGL 3101)	592	278
Basic (INGL 3102)	269	575
Basic (INGL 3201)	574	294
Basic (INGL 3202)	330	592
Intermediate (INGL 3103)	914	0
Intermediate (INGL 3104)	0	935
Advanced (INGL 3211)	402	0
Advanced (INGL 3212)	0	417
Total	3,365	3,091

Table 1 shows a total of 3,365 students enrolled in English courses at UPRM for first

semester 2010. Of this total, 2,049 or 61% of these students enrolled in Pre-basic or Basic

English courses during Fall of 2010, while 1,316 or 39% enrolled in Intermediate and Advanced

English courses. For second semester, 2011, Table 1 indicates a total of 3,091 students enrolled

in English courses at UPRM and of this total, 1,739 or 56% enrolled in Basic courses while

1,352 or 44% enrolled in Intermediate and Advanced English courses. The next table indicates

student enrollment in UPRM English courses for 2011-2012.

Table 2. *Student Enrollment for English Courses offered from 2011 to 2012*

English Courses	Year of enrollment 2011-2012	
	First Semester	Second Semester
Pre-Basic INGL 0066	0	0
Basic (INGL 3101)	495	0
Basic (INGL 3102)	181	499
Basic (INGL 3201)	446	306
Basic (INGL 3202)	182	509
Intermediate (INGL 3103)	812	0
Intermediate (INGL 3104)	0	732
Advanced (INGL 3211)	455	0
Advanced (INGL 3212)	0	423
Total	2,571	2,469

Table 2 shows a total of 2,571 students enrolled in English courses at UPRM for first

semester of 2011. Of this total, 1,304 or 51% of these students enrolled in Pre-basic or Basic

English courses during Fall of 2011, while 1,267 or 49% enrolled in Intermediate and Advanced

English courses. Additionally, Table 2 indicates a total of 2,469 students enrolled in UPRM

English courses for Spring of 2012. Of this amount, 1,314 or 53% enrolled in Basic English

courses, while 1,155 or 47% enrolled in Intermediate or Advanced Level English courses. The

next table indicates student enrollment in English courses for 2012-2013.

Table 3. *Student Enrollment for English Courses offered from 2012 to 2013*

English Courses	Year of enrollment 2012-2013	
	First Semester	Second Semester
Pre-Basic INGL 0066	0	0
Basic (INGL 3101)	578	0
Basic (INGL 3102)	0	539
Basic (INGL 3201)	390	153
Basic (INGL 3202)	214	399
Intermediate (INGL 3103)	902	0
Intermediate (INGL 3104)	0	861
Advanced (INGL 3211)	429	0
Advanced (INGL 3212)	1	387
Total	2,541	2,339

Table 3 shows a total of 2,541 students enrolled in English courses at UPRM for first semester of 2012. Of this total, 1,182 or 47% of these students enrolled in Pre-basic or Basic English courses during Fall of 2012, while 1,331 or 53% enrolled in Intermediate and Advanced English courses. Additionally, Table 3 indicates a total of 2,339 students enrolled in UPRM English courses for Spring of 2013. Of this amount, 1,091 or 47% enrolled in Basic English courses, while 1,248 or 53% enrolled in Intermediate or Advanced Level English courses.

It is important to point out this data does not reflect if students who entered through any of the above levels are repeating the course, or how many are first-time entry level students who are required to take an English course. Additionally, it should be noted during the three years cited in Tables 1, 2 and 3 (pp. 19-21), more than half of these students entered through the Basic tracks, yet many of them continued to take courses whose reading materials and in some cases, all class materials and even lectures are in English. Perhaps, we can safely assume students from Intermediate and Advanced English levels can cope with English textbooks and materials fairly well. However, the high rate of incoming students at UPRM who score below 570 English-entry level standards raises serious questions about how their English language competence might mitigate their academic performance in non-English courses which are taught in and/or employ reading materials in English. This concern further motivated me to conduct this research which is directed toward investigating the issue of language and the impact English competence might have on students' outcomes in a specific non-English courses: Pre-Calculus I (MATE 3171). As mentioned earlier, a genuine concern exists at UPRM Arts and Sciences to increase retention rates and successful completion of all courses. According to data provided from OIIP, retention rate for incoming freshmen at UPRM for Arts & Sciences totals 86.5% with students returning for their second year at 68.4% retention rate, and students who return for their third year and

60.9 % retention rate for students returning for their fourth year. For courses such as Pre-Calculus I, it is important to look at all factors concerning the problem of high withdrawal rates and non-passing grades and language should be considered as a factor in order to increase the retention rates at Arts and Sciences and also provide assistance for the successful completion of this course.

Another problem with this course has more to do with the effect of language or discourse used in the English textbook provided for MATE 3171 since there is confusion in terms of translations. Through personal communication with Dr. Damaris Santana, Associate Professor, in the Department of Mathematics, it was brought to my attention how students who enter UPRM to complete graduate courses from other Latin-American countries such Columbia, have indicated their difficulty in translating data from the course text book since the language used in it is different from the one used in their countries thus literal translations hinder students' understanding of the material. The Department of Mathematics is working on this issue, since it is of great concern since it might impact the withdrawals or non-passing grades in Pre-Calculus I, as well as other courses..

In conclusion, this study views the relationship of language and how it might affect students in Pre-Calculus I.

Enrollment, withdrawals and non-passing rates in Pre-Calculus I MATE 3171

According to Dr. Olgamary Rivera Marrero, Associate Director of the Department of Mathematics, MATE 3171 employs an English textbook while other materials and exercises are provided in Spanish. I have chosen to focus specifically on students enrolled in MATE 3171, a required course for most UPRM students.

According to UPRM's Undergraduate Course Catalog 2012-2013, MATE 3171 is a required course for most UPRM students with the exception of a handful of programs such as the Curricular Sequence in Film Studies, the Program of Industrial Biotechnology, the Department of Chemistry's Bachelor of Science in Chemistry and the Comparative Literature sequence.

The information provided in the following tables is data obtained from the admission's records from UPRM's Office of Research and Institutional Planning (in Spanish Oficina de Investigación Institucional y Planificación or OIIP) which shows the number of students enrolled in MATE 3171 from 2010 to 2011 to 2012-2013 who received a non-passing grade (D or F) or withdrew (W) in the course.

Table 4: *Student Enrollment for Mate 3171 for 2010-2011 who withdrew (W) or received a Non-passing Grade (D or F)*

Total Students Enrolled	Obtained (D)	Obtained (F)	Withdrew (W)	Totals D, F and W
First Semester, 2010				
1,487	107 (7%)	457 (31%)	304 (20%)	868 (58%)
Second Semester, 2011				
1,186	83 (7%)	537 (45%)	246 (21%)	866 (73%)

Table 4 shows student who enrolled in MATE 3171 for the first semester in 2010 was 1,487, of which 107 or 7% received a D in the course and 457 or 31% received an F. Of the total amount of students enrolled for the first semester in 2010, 304 or 20% withdrew from the course. Of 1,487 students who enrolled in MATE 3171 for the second semester in 2011, a total of 868 or 58 % received D, F or W in the course. Table 4 also indicates of a total of 1,186 students who enrolled in MATE 3171 for the second semester in 2011, 83 or 7% received a D and 537 or 45%

received an F. Of the total amount of students who enrolled in Pre-Calculus I, 246 or 21%

withdrew from the course. In total, 866 or 73% out of the 1,186 students enrolled for the second

semester of 2011withdrew from the course or received a non-passing grade.

Table 5*: Student Enrollment for Mate 3171 for 2011-2012 who withdrew (W) or received a Non-passing Grade (D or F)*

Total Students Enrolled	Obtained (D)	Obtained (F)	Withdrew (W)	Totals D, F and W
First Semester, 2011				
1,427	107 (8%)	448(31%)	327 (23%)	882 (62%)
Second Semester, 2012				
772	66 (9%)	339 (44%)	121 (16%)	526 (68%)

Table 5 shows student who enrolled in MATE 3171 for the first semester in 2011 was

1,427, of which 107 or 8% received a D in the course and 448 or 31% received an F. Of the total

amount of students enrolled for the first semester in 2011, 327 or 23% withdrew from the course.

Of 1,427 students who enrolled in MATE 3171 for first semester in 2011, a total of 882 or 62 %

received D, F or W in the course. Table 5 also indicates from a total of 772 who enrolled in

MATE 3171 for the second semester in 2012, a total of 66 or 9% received a D and 339 or 44 %

received an F. From the total amount of students enrolled in this course, 121 or 16 % withdrew

from the course. In total, out of the students who enrolled for the second semester in 2012, 526

or 68% withdrew from the course or received a non-passing grade.

Table 6: *Student Enrollment for Mate 3171 for 2012-2013 who withdrew (W) or received a Non-passing Grade (D or F)*

Total Students Enrolled	Obtained (D)	Obtained (F)	Withdrew (W)	Totals D, F and W
First Semester, 2012				
1,209	86 (7%)	397(33%)	224 (19%)	707 (59%)
Second Semester, 2013				
679	54 (8%)	265 (39%)	116 (17%)	435 (64%)

Table 6 shows students who enrolled in MATE 3171 for the first semester in 2012 totals 1,209, of which 86 or 7% received a D in the course and 397 or 33% received an F. From the total amount of students enrolled for the first semester in 2012, 224 or 19% withdrew from the course. Of 1,209 students who enrolled in MATE 3171 for the first semester in 2012, a total of 707 or 59% received D, F or W in the course. Table 6 also indicates of a total of 679 who enrolled in MATE 3171 for the second semester in 2013, a total of 54 or 8% received D and 265 or 39% received an F. Of the total amount of students who enrolled in this course, 116 or 17% withdrew from the course. Of 679 students who enrolled in MATE 3171 for the second semester in 2013, 435 or 64%

withdrew from the course or received a non-passing grade.

The data from all three tables (pp. 24-26) show student performance is less than optimal. The data presented for these three years exhibits a pattern occurring with this particular course which does not favor students or the course as a whole, plus it justifies the need to carry out more research in this area.

Considering the aforementioned data, this study intends to show the relationship between English competency and student retention and performance in this particular Math course in order to explore to what extent the latter might be due not exclusively or mainly to students' mathematics abilities, but to their English language skills.

In conclusion, given the data provided in Tables 4, 5 and 6, and highlighting that although the reasons for the lack of student success is uncertain, and given the varied levels of English proficiency of UPRM of students who enroll in MATE 3171, this study constitutes an effort to examine a relationship between English ability and academic performance, in order to explore if language is a factor which affects students' non-passing grades and high withdrawal rates.

Chapter Two: Review of Literature

A rise in higher education enrollment has affected students in the United States for more than four decades. Census Bureau statistics show the number has increased from 52% enrollment during the 1970's, to 70% in 2009. (census.gov/Educational Statistics, 2010). Cross (1971), refers to a quantitative study on the historical nature and philosophies of higher education to discusses the changes which ultimately brought about the interest of an open door policy so a college education would not be solely a privilege for the elite, but rather for a larger community, avoiding therefore, discrimination and promoting education for the poor and underprivileged as well. Her study sustains that as a result, institutions have developed a "revolving door" policy. The implications of this study suggest that not only there has to be more to higher education than its accessibility, but rather a restructuring of education at all levels. Data from her research claim there exists learning problems on behalf of students which are a consequence of their prior learning experiences during their elementary and secondary education. During the past decades, higher education enrollment has also increased in Puerto Rico. From 24,532 in 1960, the number of students enrolled in colleges has increased to 250,000 students in 2006. ("The Economy of Puerto Rico: Restoring Growth", 2006). Although, we cannot compare UPRM's enrollment to the "open-door" policies described in Cross's (1971) study which centers on the existence of community colleges that sprang up weekly during the time her study was being conducted, there is nonetheless, a similar concern of under-preparedness of students in elementary and secondary schools which may have a direct effect on first-year students enrolling at UPRM, especially in the area of Mathematics.

Cross's (1971) research, an initial concern which motivated the focus of this study toward the area of mathematics has been Puerto Rican students' pattern of low grades in this subject.

During my teacher certification practice at an intermediate school in Isabela in 2009-2010, I was invited to attend a meeting for all faculty. Information on the outcome of the school's Puerto Rican Standardized Tests (in Spanish Pruebas Puertorriqueñas de Aptitude Académica or PPAA) was distributed. According to the 2008-2009 results, 100% of students from seventh and eighth grade classes in this school failed Mathematics (S. Crespo, personal communication, October 30, 2009). Additionally, according to statistics of Department of Education of Puerto Rico (DEPR), during 2008-2009, three percent of students enrolled in eighth grade statewide were proficient in mathematics (Progreso Acádemico, Informe del Perfil Escolar para Puerto Rico 2009-2010). These results are supported by research from the Institute for Educational Science's National Center for Educational Statistics (NCES) of 2007 which focused on public school students in Puerto Rico from fourth to eighth grade. The researchers supplied a Spanish-language version of the National Assessment of Educational Progress (NAEP) in mathematics. By using a representative sample of approximately 2,800 students from 100 public schools, they assessed grades in various math questions dealing with content such as number properties and operations, measurement, geometry, data analysis and probability, and algebra. These questions were also asked to students in the United States in order to evaluate and compare results. The study shows at both fourth and eighth grade levels, the scores on the NAEP mathematics assessment were lower for students in Puerto Rico than for public school students nationwide. The study found the averages of questions scores were 0.26 for fourth graders and 0.25 for eighth graders in Puerto Rico, compared with the national scores which averaged 0.55 and 0.51 respectively (p. 11). Broken down by grade, the study showed that for fourth graders, "The average of the questions scores for students in Puerto Rico was lower than the score for students in the nation overall and within each content area" (p. 27). Additionally, the overall average of question scores for eighth

graders in Puerto Rico was also lower than scores for students on a national level. Similar to the results for fourth graders, eighth graders also scored lower in each content area than those nationally. This data indicates a concern in the outcome for Puerto Rican students' math grades prior to high school level which can provide crucial evidence of their under preparedness as they continue their subsequent studies, particularly in their enrollment in math in higher education.

Furthermore, if we look at research which focuses on high school math courses like Pre-calculus and its impact on completing a bachelor's degree, Adelman (1999) evidenced through an extensive study of college degree completion, if students finished one course beyond the Algebra 2 level (which included trigonometry or pre-calculus) during high school, their probabilities of completing their bachelor's degree more than doubled. He suggests this is one of the strongest pre-college curricula which influence degree completion. Continuing along the same lines as Adelman (1999), Trusty and Niles (2003) examined the influences of math course-taking in high school; they explored how it extended beyond the influences of students' reading and math ability in the eighth grade. The purpose of their study was to examine the effects of background variables and students' high school math curricula on completion versus non-completion of a bachelor's degree. The researchers examined data spanning 12 years, from eighth grade up to eight years after high school; their study focused on the effects of intensive high school math course-taking (such as trigonometry, pre-calculus and calculus) and more importantly, it included the variable of their eighth grade cognitive ability. Their research found that of all the high school curricular areas and courses, credits in intensive math courses were most strongly related to degree completion; even more than science courses; this concurs with Adelman's prior study. Trusty and Niles' (2003) research further determined that eighth grade math ability affected math course-taking in high school, which in turn affected bachelor's degree

completion. Trusty and Niles (2003) found, "…early math ability had an indirect effect on degree completion via math course-taking in high school" (p. 103). This concern is sustained by Pang (2010), especially as it affects higher education. Pang (2010) agrees that despite socioeconomic setbacks and or lack of motivation, an important factor leading to dropout or non-completion of higher education is poor academic performance. As Pang (2010) points out, "…the real problem for struggling students is their lack of skill in mathematics" (Strengthen Math Education…, para. 1). He affirms math and science courses are the most difficult for students. Additionally, Pang (2010) concurs with Edelman (1999) and Trusty and Niles (2003) because he agrees the only way to improve retention and successfully see students toward graduation is to, "correct their math deficiencies before they advance to more-demanding courses"(Strengthen Math Education…, para. 5). Needless to say, these studies seem to agree that early math ability is crucial for student success in high school and undergraduate studies. This is a relevant issue which needs further analysis in my own study because results like these suggest there may be crucial issues other than just language impacting student performance and retention in a university entry-level Mathematics course like (MATE 3171). Although literature such as the above-mentioned suggests students in the United States as well as Puerto Rico might enter college ill-prepared in math, there is no evidence of research which explores to what extent students' low performance in math at any level including college, may be due not exclusively to previous preparation in high school, but to language. When referring specifically to UPRM students, the issue of language should be considered, especially as it refers to students in the Pre-Basic and Basic English track and the possible difficulties which may arise from a course such as MATE 3171 which may employ textbooks or course materials in English.

Additionally, in order to focus on the impact language competence might have on the retention rate in UPRM, it is important to review literature which analyzes the issue of remedial courses concurrently given with college non-English classes. For example, in UPRM, students take remedial English courses concurrently with subjects such as Pre-calculus. The same is the case in some universities in the United States. Illich, Hagan and McCallister (2004) who conducted a study at McLennan Community College in Waco, Texas in light of a concern with the open-door admissions policies of many community colleges; they noted most students demonstrated a lack of preparedness in subjects such as English, math, and reading. Students who participated in this study were enrolled in this college during at least one of the following three semesters: Fall 1999, Fall 2000, and Fall 2001. They were given proficiency tests and then placed in remedial courses on subjects they needed improvement. This particular research evaluates the assumption that student under-preparedness is limited to a specific area by assessing the college-level performance of students who were concurrently enrolled in remedial and college-level courses. The study found the college-level passing rates were much lower among students who were concurrently enrolled in remedial courses and who did not successfully complete one or more of these remedial courses. In other words, if they completed and passed their remedial courses, they also approved their college-level courses.

Although the Illich, Hagan and McCallister's (2004) study was conducted in the United States, it provides this research with background evidence of cases which outline the importance of remedial courses, such as Basic English, and how their completion can lead to success in other college level courses, such as UPRM's MATE 3171. It further justifies my interest in examining to what extent mastery of basic skills in Mathematics at an elementary or high school level is preconditioned for college success which may impact student retention rates in MATE 3171.

In the past, at UPRM the subject of English language learning and its effect on non-English courses has been approached by Drs. Mazak and Rivera who conducted an analysis of content-based, technology enhanced Basic English Curriculum which was offered to Agricultural majors at UPRM in order to examine to what extent a combination of the four areas of learning could improve students' English learning within a non-English course. They offered this new curriculum, a modified model known as Cognitive Academic Language Learning Approach (CALLA) to a sample of thirty agricultural major students beginning in the summer of 2008. This curriculum consisted of a three-semester sequence which integrated the learning of agricultural content, English language, academic strategies and technology use. The study found the curriculum improved students' skills in all four areas and the design also served to increase student motivation to learn English and make a smooth transition to college life by offering them the orientation needed for their chosen field of study (Mazak and Rivera, 2008). Their findings coincide with those reported by Illich, Hagan, and McCallister (2004) since both establish how students who successfully completed remedial courses are better prepared to approve their college-level courses. It is important to note how both studies open the doors to this research because they are at the forefront when dealing with the importance of English competency and its significance to non-English courses.

Studies centering on retention in mathematics courses have also been developed at UPRM, specifically in the area of students approving their first course of mathematics in this institution. Quintana (2007) presented a descriptive study of first-year students enrolled at UPRM from 1990-2005. This study considered characterizing the students attending the course Calculus I (specifically, first year students enrolled during Fall, 2006-07) based on their academic performance and other related factors. The study found student enrollment index had

increased despite evidence that grades acquired from their College Entrance Board in different areas had lowered considerably. Furthermore, considering the enrollment index is a weighted average in sections such as Verbal and Mathematics Aptitude in the College Board Entrance Examination, the increase in the enrollment index average at the high school level had increased despite the decrease in the student grades obtained in the different components of the university entry level exam. Additional related factors which were taken into account were students' attitude toward mathematics, professors' teaching methodology, characteristics of the exams provided, academic lagging, time and effort dedicated in the preparation of the exams, group study, and review of class work, social surrounding and attitudes concerning the course. The results showed professor's methodological characteristics as well as students' academic characteristics were important predictors of their academic performance.

In order to explore student success in mathematics, Odiott (2010) sought to determine if factors such as the schools students derived from, the type of school (public or private) they attended, their social-economic status and the results from their College Board scores, especially in the areas of mathematics were strong indicators of student success. This study concluded that high school averages, student grades from mathematics high school math scores and student grades from the mathematics aptitude portion of the College Board were recurring factors which mostly influence student performance in their first mathematics course. Although this study also considers some of these factors, it focuses on Pre-Calculus instead of mathematics at a general scope. Additionally, Odiott (2010) does not consider language as a possible component and how it may play a part in first year students' withdrawal or success rate in passing mathematics. Indeed, this gap is a valid factor which is worth further study. Odiott (2010) sought to introduce a discriminate analysis in order to establish a mathematical model which generates an equation

which would enable, with a certain margin for error, to predict which students would succeed, or

fail the course. According to Odiott (2010), these results could be used to identify students at risk

of failing so that preventive measures could be adopted to avoid this from happening and thus,

lower the percentage of students who fail first-year mathematics. Although Odiott's (2010)

research paves the way for my own study, I question whether the intentions of a prediction

equation such as this may hinder students' chances of entering UPRM. The model, applying the

factors mentioned in Odiott's (2010) research may be used as a discriminating pre-admissions

tool, instead of one which fosters creating institutional changes designed to help students pass

their course hence complete their degree in a timely fashion.

As set forth in the introduction, the objective of this study is to provide data which could

help improve the retention rates and students' performance in mathematic courses, particularly

those students enrolled in the Basic English track, and ultimately serve the institutional

commitment to academic excellence at UPRM. Recently, the Mathematics Department at

UPRM, in keeping with this goal, designed, implemented and piloted an experimental mega

section of Pre-calculus, which consisted of 150 students. This large lecture format class was

reinforced with the use of technology and an additional hour of class per week workshops, where

groups of 25 students would meet with an assigned teaching assistant (TA) to practice problem

solving and study habits. In this pilot project, presented for the first time during the Fall 2008-

2009 through Spring 2009-2010, the syllabus and content standards, as well as the departmental

examinations (three midterms and one final) were the same as in the regular sections. It should

be noted the sample used for the first experimental section consisted of a randomized sample

taken from incoming freshman students, who were taking the course for the first time. Also, the

course was given by the same educator for all sections of this experimental program (Brusi,

Portnoy and Toro, 2013, p. 20). During the fourth semester (Spring 2009-2010) the pilot course

was given for Pre-calculus II and the content was therefore, different in this case.

      The results of this experimental section, from Fall 2008-2009 through Fall, 2009-2010,

showed this method was more effective than the others when comparing grade distribution

between all other sections, especially for students who took this course for the first time. When

the mega section was replicated during Spring, 2008-2009, mostly for students repeating the

course, of 150 students who were assigned, 6.15 percent more students passed the course

compared to traditional sections, demonstrating the effectiveness of this program; it was suited

for first year students taking this course for the first time (p. 21). During a meeting with Dr.

Olgamary Rivera Marrero, Associate Director of the Mathematics Department, she indicated this

course is still offered in this manner; however, Professor Nilsa Toro, co-author of the study,

utilizes clickers in the classroom. Dr. Rivera added that the rest of the pre-calculus sections are

offered in mega sections with an additional hour in small group workshops (O. Rivera, personal

communication, July 3, 2014). The calculus course is offered by Dr. Arturo Portnoy, who teaches

mega sections and the additional problem solving hour, does not include the use of clickers.

      As indicated in Table 4, 5 and 6 of this study (pp. 24-26), for students enrolled In MATE

3171 during Fall of 2010 and Fall 2011, 868 or 58% received a D, F or W. During Fall of 2012,

701 or 58% of students enrolled in this course received a D, F or W. Consequently, despite the

efforts mentioned in Brusi, Portnoy and Toro's (2013) project, data from OIIP for 2010-2011 to

2012-2013, demonstrates an increase which shows 2,443 or 59% of students receiving a non-

passing grade in MATE 3171 or withdrawing from MATE 3171 altogether during first semester

enrollment. It is important to point out however, there were external factors which systematically

impacted all courses on campus during spring, 2010. The change in numbers may be viewed as a

consequence of the system-wide student strike which affected all eleven campuses at University

of Puerto Rico during this time. In conclusion, the literature outlined in this review not only

attests to the importance of preparing students in Mathematics courses because of the

significance it poses toward completion of higher education, but also the commitment UPRM's

Mathematics Department has demonstrated on the issue of withdrawal rates and non-passing

grades in Pre-Calculus I.

      This study looks at the importance of institutional awareness and assistance in order to

raise retention rates, especially for first year students and literature from Vincent Tinto poses

alternatives for this initiative. Although his theory identifies student commitment as an important

factor for retention, his Interactionalist theory sets forth important arguments and

recommendations regarding institutional commitment. His studies on student departure have

been instrumental in understanding this phenomenon. Tinto (1993) avoids singling out any one

action or set of actions as being the primary cause of student departure and sustains that

> In the interactive system of a college, almost any institutional action, whether in
>
> admissions, counseling, advising, academic programs and classrooms, or student life, will
>
> eventually affect student persistence and will do so in often unintended and quite
>
> unexpected ways (p. 205).

      In other words, it is not only the social and academic integration on behalf of the student,

or lack thereof, which constitutes or is responsible for dropout and/or retention rates for college-

level students, but also the development of institutional educational missions which should be

implemented in order to establish and employ a retention policy which establishes specific

commitments to students entering the university. For Tinto, "…institutions of higher education

do have a special responsibility on the domain of student retention" (p. 205), and the results of

this study can provide data in this area. This contention is echoed by Cross (1971) who sustains

that at the level of postsecondary education, "…we will probably make better progress if we

regard learning as a joint responsibility of learner and teacher" (p. 54). Since Tinto's

interactionalist theory discusses the importance of institutional commitment and intervention as a

factor for student departure and stresses the importance of their intervention, Tinto's work is

being employed as the guiding theoretical framework of this study. His theory captures the

institutional accountability concerns raised by the data presented previously with regard to

student retention and performance in MATE3171, which is a required course for the vast

majority of UPRM students.

Tinto (1993) claims that "…once a student is accepted for admission, the institution has a

responsibility to insure they are provided with the resources and opportunities needed to

complete their courses" (p. 209) and comments that the importance of institutional commitment

is vital for reducing student retention and part of this commitment is to, "supply resources

needed to students who are having trouble with university courses" (p. 209). Considering prior

research on the subject of low retention rates, and taking Tinto's Interactionalist theory as the

basis of the theoretical framework, the objective of this study is to contribute by identifying areas

of concern which may be used by the Department of Mathematics. Barefoot (2004) sustains

current research has focused more on student characteristics, but have paid little attention on the

classroom itself, specifically the basic structure of higher education, especially the way

instruction is designed and delivered (p. 9). Although UPRM continues to study the causes for

the high withdrawal and/or non-passing grades in MATE 3171, the issue of institutional

commitment will benefit greatly by extending the mechanism of instructional strategies provided

in studies such as Brusi, Portnoy and Soto (2013) to also concentrate on course structure,

delivery of material to students and other areas of teaching techniques including language issues, which may influence the course.

Anecdotal data gathered during the six semesters at the English Department at UPRM, where I regularly engaged my students in conversations about the math course they took, showed most of the comments were about them confronting difficulties. These informal and unstructured exchanges include how UPRM often offers MATE 3171 in an amphitheater with groups of approximately one hundred students taking the course simultaneously. As mentioned previously, Brusi, Portnoy and Toro (2013) identified these courses as mega sections for MATE 3171. Unfortunately, students indicated, that during the course of the semester, the section can dwindle to approximately 20 students. Surely, students cannot feel a sense of integration from this type of learning environment. Tinto (2003) refers to this type of university learning as disconnected and detached. More importantly, he refers to it as a, "spectators sport" largely due to the fact that, "…faculty talk dominates and where there are few active student participants" (p.1). A teaching environment such as this does little to promote student retention and the data regarding the high incidence of withdrawal and/or non-passing grades mentioned earlier attests to this point. The difficulty of teaching environments, combined with possible language competency issues, especially for students from the Pre-Basic and Basic track, might add to the complexity of the course and possible reasons for students' decision to withdraw. It is fair to acknowledge that Brusi, Portnoy and Toro's (2013) project has complimented the mega sections of MATE 3171 with the use of problem-solving workshops as well as including clickers in order for the Department of Mathematics to be attentive to this variable in these larger sections.

Finally, in order to explore language learning and how it may affect retention rates in MATE 3171, it is also necessary to briefly examine the island's language history in order to

study to what extent the use of English might stem from the attitudes which have been

historically integrated. Puerto Rico was colonized by Spain in 1493. After the Spanish-American

War of 1898, the United States, under the Treaty of Paris, occupied the island and this is where

"the contact between the two languages abruptly intensified" (Pousada, 1999). During this time,

and in order to deal with the high illiteracy rate on the island, the military government

established by the United States Congress created "universal, obligatory, and free education on

the island"(Pousada, 1999). The mission was to promote Americanization via the English

language and as a result, English instituted as the mandatory language for education.

Furthermore, there existed a preferred hiring of English-speaking teachers who were sent to the

island to teach in schools. From 1898 to 1949, the educational language policy changed seven

times, switching language instruction, focusing precisely on how English should be taught.

Although there has been over a century of association with the United States, lack of English

language fluency still exists in Puerto Rico. According to the 2000 census, language use on the

island of Puerto Rico by those who are five years and older is reported to be as follows: 85.6 %

use Spanish at home. In April, 2010, the Census Bureau released a table titled, "Detailed

Languages Spoken at Home and Ability to Speak English for the Population 5 Years and Over

for Puerto Rico: 2006-2008." This table demonstrates out of 3,695,811 of the population five

years or over, only 174,269 or five percent speak English in the household, while 3,521,542 or

95 % spoke a language other than English at home. The table indicates from the population who

speaks a language other than English at home, 3,517,228 or 99.9 % of this total speak Spanish.

The table also indicates from the population who speaks Spanish at home, 2,998,937 or 85

percent of this population; spoke English less than "Very Well." (Appendix A). The reality is

only a small portion of Puerto Ricans speak English, and most are not near native speakers.

In the case of students who enter UPRM from both the public and private schools sectors

on the island, they have had twelve years or more of English by the time they graduate from high

school, yet many still struggle with the language at university level, as demonstrated by data on

Basic English entry levels demonstrated in Tables 1, 2 and 3 provided in the introduction (pp.14-

27). This is where this research stands to make a contribution because a course such as MATE

3171, and the materials offered require a certain level of English proficiency in order for students

to understand the textbook, materials and class instruction, especially when provided in English.

Considering the impact of Puerto Rico's historical English learning coupled with the difficulty of

the course content, a concern arises as to what extent does English, whether used in language

teaching or in materials for this course, affect the non-passing grades or withdrawal rates for

students who must take this course to graduate from UPRM. Additionally, it is important to keep

in mind if Latin American graduate students who travel to Puerto Rico to attend UPRM in order

to complete their post graduate studies and teach pre-calculus, will English impact how they

impart their instruction. As mentioned in the introduction of this study, (p. 14), there is also a

concern as to the discourse in English textbooks and how it might cause a language issue which

in turn might affect the outcome of students' performance in MATE 3171. Through personal

communication with Dr. Damaris Santana, Associate Professor, in the Department of

Mathematics, some students who enter UPRM to complete graduate courses from Latin-

American countries such as Columbia, might have difficulty translating information provided in

the textbook because the discourse being applied is different from the one used in Puerto Rico.

That is, they use terminology from their country or translate literally and this has caused some

difficulties in the course. This again, points to language, in this case, Spanish other than Puerto

Rican Spanish, as a factor which might contribute to withdrawals and non-passing grades in Pre-

Calculus l. However, the use of Spanish from other countries goes beyond the scope of this study in which English is the only language examined.

Research questions

The first question in this study: Is there a relationship between English proficiency and academic performance in MATE 3171? The general research question arises primarily after examining data from OIIP from 2010 to 2012 which indicate a tendency for more than half of the students enrolled in this course to obtain a non-passing grade (D or F) or to withdraw (W) from the course. As mentioned previously, one of the variables which has not been explored is the effect language may have on this tendency.

The second question of this study: Is there a relationship between the grade received in MATE 3171 and the type of high school student attended? Studies and readings outlining a concern for math scores in Puerto Rico's public schools referred to in the review of literature (p. 28) have prompted an question which finds the relationship of both public and private school math courses and to what extent it may affect student performance in their undergraduate math courses.

The third question of this study: To what extent English language proficiency plays a role in students' difficulty in passing Pre-calculus I? Given this course's textbook is in English and professors may offer the course either in Spanish, English or a combination of both, the syllabus for Pre-Calculus I was uploaded and perused from the Department of Mathematics' webpage. The observation made from this document was that the book employed is written in English, regardless of whether the syllabus was written in Spanish or English. Additionally, through anecdotal information afforded by students who took my English class, there are times, when MATE 3171 is offered entirely in English, Spanish or a combination of both. As a result, a

concern arises about students' level of understanding course material which may be provided in English.

The fourth question in this study: How do students perceive the usefulness of English in Pre-calculus I and the extent which is needed to understand the textbook and additional materials in the course? In order to examine this occurrence using qualitative data collected through a questionnaire, participants provided their view on the level of English needed to understand the textbooks and course. It is important for this study to evaluate student replies in order to understand how language affects their successful completion of MATE 3171.

The next chapter will describe the method used to collected data for this study in order to answer the research questions outlined above.

In summary, these are the research questions:

1. Is there a relationship between English proficiency and academic performance in MATE 3171?

2. Is there a relationship between the grade received in MATE 3171 and the type of high school student attended?

3. To what extent English language proficiency plays a role in students' difficulty in passing Pre-calculus I?

4. How do students perceive the usefulness of English in Pre-calculus I and the extent which is needed to understand the textbook and additional materials in the course?

Chapter Three: Methodology and Materials

This study uses a mixed methods approach utilizing data from quantitative and qualitative sources. The method used to carry out this investigation includes the population under study, description of the design and sample, the instrument used and how the collection of data was carried out.

The University of Puerto Rico at Mayaguez, upholds institutional policy which requires all researchers who intend to work with people, to fill out an application and submit it to the Committee for the Protection of Human Beings in the Investigation (in Spanish CPSHI/IRB) along with the questionnaire and informed consent. The committee evaluated and determined it could not be sent to students via university email as I had originally designed in order to target a larger population. An option was to send the potential participants an email inviting them to meet on a specific date and time in order to fill out a hard copy after introducing the study to them. This original application was approved on December 21, 2011 (Appendix B).

A subsequent extension and modification was requested on January 28, 2013. Drs. Damaris Santana and Wolfgang Kolke of the Mathematics Department recommended employing the data needed for this study from second semester students particularly those enrolled in August, 2012, rather than the original selection of 2010 cohort. The Committee highlighted I should take into consideration the extraordinary circumstances of the student strike which took place throughout the entire University of Puerto Rico system during 2010; hence, we agreed the data collected for the 2012-2013 cohort would have more validity for this study. On February 6, 2013 after CPSHI/IRB's deliberation on the modifications submitted, the committee determined this study to be within normal educational practices brought about within an academic context

and therefore exempt of all requirements, including the use of an informed consent (Appendix C).

Population under study

  The population for this study is first-year students whose student identification number was 802-12-xxxx and had enrolled in Pre-calculus I for Fall, 2012 and Spring, 2013. The information used in this study was obtained from UPRM's Office of Research and Institutional Planning (OIIP). The Registrars' office and OIIP did not provide any sensitive information identifying student names or student identification numbers; however, they did supply information tied to a "dummy number." The data received provides information on academic placement and grades obtained for first semester students enrolled in this course, as well as placement and grades for the English course they had enrolled in.

Description of design and sample

  The information gathered by descriptive analysis, was used to compare first-year students enrolled in both Pre-calculus I and English in an attempt to make a generalization of a larger group, thereby determining patterns which arose in both the Pre-calculus I and English courses. This study specifically targets first-year students enrolled in MATE 3171 at UPRM during 2012-2013 given that 1,318 or 59 % of students withdrew or received a non-passing grade (W, D and F) for this year. It should be noted the total students mentioned previously are from those who either took MATE 3171 for the first time as well as those who repeated the course. If we look specifically at first year students who enrolled in MATE 3171 during 2012-2013 and are part of the population examined, a total of 1,121 first-year students enrolled in this course.

Three tests were performed using a chi-square analysis for each in order to find relationships between these two courses and factors which may affect students successfully passing MATE 3171. Tables 4, 5 and 6 (pp. 24-26) demonstrates a tendency for a high number of withdrawals (W) or non-passing grades (D, F) from this course consistently since 2010.

A descriptive analysis was obtained from data provided by OIIP; it outlines first year students enrolled during August, 2012, which include grades received in both Pre-calculus I and English courses in order to summarize and discover trends among this group, specifically as trends concerns English and non-English courses. According to Best, a descriptive research is concerned with "conditions or relationships that exist; practices that prevail … or trends that are developing" (as cited in Cohen, Manion, & Morrison, 2003, p. 186).

Figure 1 shows, a descriptive analysis for a random sample of 1,121 students enrolled in MATE 3171 during August, 2012.

Grade distribution for students enrolled in Pre-Calculus I, August 2012
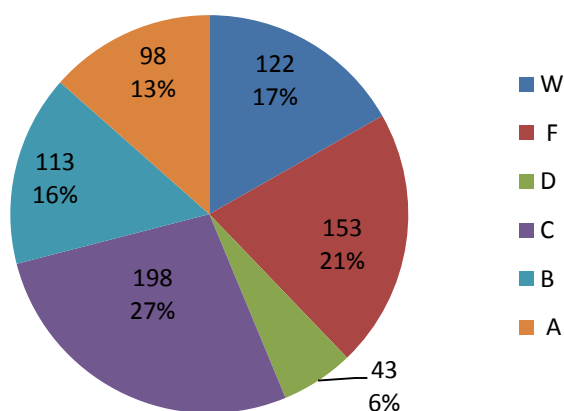
Figure 1. Graphical distribution of grades for students enrolled in MATE 3171, August 2012

The distribution of grades for first-year students enrolled in MATE 3171 during August, 2012 shows that out of 727 students enrolled during this period, a total of 122 or 17% received W, 43 or six percent received D and 153 or 21% received an F for a total of 318 in other words, 44% did not pass this course during the semester of Fall 2012. This amount contrasts to 409 or 56% of students who received A, B or C during this first semester (Figure 1).

Figure 2 below, shows a descriptive analysis to summarize and discover trends among 394 first year students who enrolled in MATE 3171 during Spring, 2013.

Grade distribution for students enrolled in Pre-Calculus I, Spring 2013
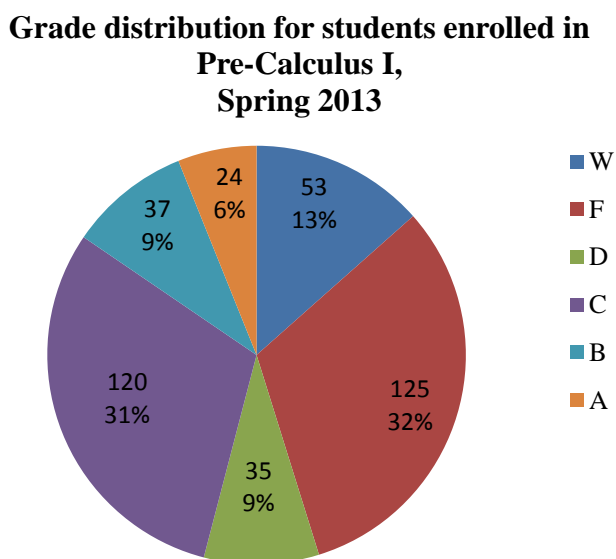
Figure 2. Graphical distribution of grades for students enrolled in MATE 3171, Spring, 2013.

Figure 2 demonstrates that out of 394 students enrolled Pre-calculus I during Spring, 2013, a total of 213 or 54% did not pass the course. This amount contrasts to 181 or 46% who passed the course. Although there is a reduction of first year students enrolled during this semester, there is an increase of non-passing grades (W, D, F). Because of OIIP's decision not to provide student numbers, it was not possible to ascertain with exactness, which of the students

who enrolled during August, 2012 repeated the course during Spring, 2013. However, by finding

duplicate data of dummy numbers which were provided in the data sheets received by OIIP, we

discovered out of 394 who enrolled in MATE 3171 during Spring, 2013, 133 or 34% first year

students were repeating the course.

Statistical Analysis Chi-square Tests

Three chi-square analysis tests were performed using data provided by OIIP in order to

determine relationships in separate areas of concern for this study. A chi square statistic is

considered a statistical quantity equal to the summation over all variables of the quotient of the

square of the difference between the observed and expected values divided by the expected value

of the variable. Chi-square $(\chi)^2$ charts the difference between statistically expected and actual

scores. (Cohen, Manion, & Morrison, 2003). The data provided by the chi-square tests described

below seeks to find relationships, and/or possible trends in order to arrive at a generalization of a

larger group. The information provided is a key component in order to find viable institutional

solutions where language is a concern which needs to be explored.

Using the following independent variables: The grade obtained in MATE 3171 and type

of high school (public or private) students attended, if there exists a relationship between the

final grade obtain in students' English courses with the high school students attended, and if a

relationship exists between students' final grade in English courses and the grade obtained in

MATE 3171. The data identified any relation among the variables which can be pointed out,

providing a measurement of how expectations compare to results.

Data from Puerto Rico's standardized tests (PPAA or Pruebas Puertoriqueñas de Aptidude

Académico) provided during my teacher certification practice show that students in the public

schools do not perform well in mathematics in elementary and secondary levels, and therefore I

hypothesized that private school students would fare better than public school students and chi-square test #1 will shed light on this question.

Chi squared test #1 –Relationship between grade received in MATE 3171 and the type of high school student attended.

Using chi-square statistical test with data obtained from OIIP, this test measures if a relationship exists between the grade received for MATE 3171 and the type of high school student attended. The Chi-Square test showed relationships about independent hypotheses parting from the following assumptions:

Ho: There does not exist a relationship between the grade obtained in MATE3171 and the type of school student attended.

Ha: There does exist a relationship between the grade obtained in MATE3171 and the type of school student attended.

The chi-square test executed using the hypotheses mentioned above will reveal one of two results:

Null or XY are independent

Alternate or XY is not independent.

A hypothesis test was then performed to achieve an inferential result by examining the independence of the following qualitative variables in order to determine relationships:

X: "Grade received in MATE 3171 and public school."

Y: "Grade received in MATE 3171 and private school."

The figure below is a sample of a chi-square distribution
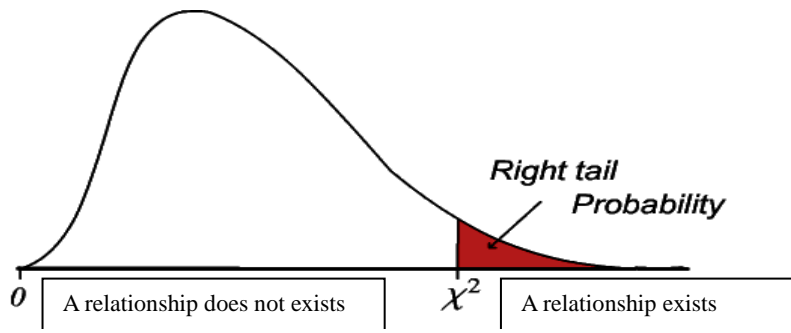
Figure 3. Chi-square distribution

Examining the Figure 3 shown above, the white portion corresponds to the non-rejection of the null hypothesis, whiles the red portion (also called the distribution tail) corresponds to the rejection of the null hypothesis.

Using a Chi-square test demonstrates whether there is a significant relationship between variables, but it does not say just how significant and important this is.

In addition, in order to measure the merits of the association between two variables, we used Cramer coefficient. Cramér's V (sometimes referred to as Cramér's phi and denoted as φ_c) is a measure of association between two nominal variables, giving a value between 0 and +1 (inclusive) and is based on Pearson's chi-squared statistic. Cramér's V is computed by taking the square root of the chi-squared statistic divided by the sample size and the length of the minimum dimension (k is the smaller of the number of rows r or columns c). Cramer's V is used as a post-test to provide this additional information. Cramer's coefficient was calculated using Minitab. The formula for the φ_c coefficient is:

$$\phi_c = \sqrt{\frac{\varphi^2}{(k-1)}} = \sqrt{\frac{\chi^2}{N(k-1)}}$$

Figure 4. Formula for φ_c coefficient

Cramer's V varies between 0 and 1. Close to 0 shows there is little association between variables; while close to 1 indicates a strong association.

Test #2 –Relationship between grades received in UPRM English courses and the type of high school student attended.

The second chi-square statistical test performed from data obtain from OIIP measures if a relationship exists between the grade received for UPRM English courses and the type of high school student attended. The chi-square test showed relationships about independent hypotheses parting from the following assumptions:

Ho: There does not exist a relationship between the grade obtained in English courses and the type of school student attended.

Ha: There does exist a relationship between the grade obtained in English courses and the type of school student attended.

These steps were followed to perform a hypothesis test to achieve an inferential result.

The chi-square test executed using the hypotheses outlined above will reveal one of two results:

Null or XY are independent

Alternate or XY is not independent.

A hypothesis test was then performed to achieve an inferential result by examining the independence of the following qualitative variables in order to determine relationships:

X: "Grade received in UPRM English courses and public school."

Y: "Grade received in UPRM English Courses and private school."

In addition, we used Cramer's coefficient in order to measure the merits of the association between these two variables. Cramer coefficient was calculated using Minitab.

Test #3: Relationship between grades received in English courses the grades received in MATE 3171

The third chi-square statistical test performed on the data obtain from OIIP measures if a relationship exists between the grade received for MATE 3171 courses and English courses available in UPRM. The chi-square test showed relationships about independent hypotheses parting from the following assumptions:

Ho: There does not exist a relationship between variables X and Y (no independence)

Ha: There exists a relationship between variables X and Y (independence)

These steps were followed to perform a hypothesis test to achieve an inferential result.

The chi-square test executed using the hypotheses outlined above will reveal one of two results:

Null or XY are independent

Alternate or XY is not independent.

A hypothesis test was then performed to achieve an inferential result by examining the independence of the following qualitative variables in order to determine relationships:

X: "Grade received in UPRM English courses and public school."

Y: "Grade received in UPRM English Courses and private school."

 In addition, we used Cramer's coefficient in order to measure the merits of the association between these two variables. Cramer's coefficient was calculated using Minitab.

Instrument and data collection for qualitative study

The data collection for the qualitative portion of this study was performed by administering a seven item questionnaire developed and subsequently validated, designed to meet with the objectives of the study (Appendix D). After meeting with Dr. Damaris Santana and

Dr. Wolfgang Rolke and based on their experience, they pointed out how inviting or supplying a

questionnaire though email had not resulted as a successful strategy because, in the past, students

taking math courses had failed to answer the online survey they sent. Their suggestion was to go

directly to the classrooms because then potential participants will be gathered in one place. In

order to satisfy the Committee for the Protection of Human Beings in the Investigation's (in

Spanish CPSHI/IRB) concern about having a captive audience, we acquired permission via a

formal letter to Dr. Omar Colón, Director of the Mathematics Department (Appendix E). Dr

Colón reviewed the request and referred the matter to Dr. Pedro Vasquez Urbano, Course

Coordinator of MATE 3171. Needless to say, there was concern about disturbing the teaching

process, so much so, Dr. Vásquez only allowed access to student workshops; which is an

additional hour a week used for problem solving and is taught by teaching assistants. Moreover,

Dr. Vasquez indicated that entry to the mega-section taught by a professor was not advisable. In

order to collect data for this study, we used course information supplied by Dr. Olgamary Rivera

Marrero, Assistant Director of the Mathematics Department. According to course registration for

January, 2013, 22 sections of MATE 3171 were being offered with a total of 650 students. The

class sizes ranged from 25 students to 56 students. Although I was not authorized access to the

mega section which had a total of 120 students, from the 530 potential participants, 270

participated in this investigation and the questionnaire to collect qualitative data (Appendix F).

Dr. Vásquez also established the dates to conduct this study and they were from Monday

to Wednesday: March 5 through March 7, 2013, and only during the last eight minutes of each

class. In more than three occasions, this time was cut short so the investigator or assistant had to

plea students for a little patience and more time in order to fill out the questionnaire. As a

consequence, many participants did not complete the questionnaire, especially when they read

the part which asked their reasons for withdrawing from the course. Furthermore, because it was a workshop, attendance was half in many of sections visited, thus cutting the target amount of the participants originally anticipated. These were some of the setbacks faced in collecting the data for this study.

The seven-item questionnaire was administered in Spanish (an English version is included in Appendix E), and asked if participants had repeated MATE 3171. This question intended to target students who received a D, F, or W during their first semester. At this point, the participation ended for students who were taking this course for the first time. The next question asked if students attended a bilingual school. This question required a Yes or No answer, but also contained boxes so the participant could check the level they attended: elementary, intermediate and/or secondary. The goal of the information acquired through this question was for students to self-report their language background.

Questions three and four is a self-assessment of the usefulness of the English students learned in high school for their UPRM courses, and question four asked the usefulness of the English students learned in high school for MATE 3171 by using a Likert scale, participants could evaluate these questions using one (of little use) to ten (very useful). These two questions were included not only to receive participants' perception of English language use and how it applies to the success of UPRM courses, but also to evaluate their view of how English serves Pre-calculus.

Question five also aimed at language use by asking, "Which language did your previous professor use to offer the MATE 3171 course? Three choices were provided: English, Spanish and Both. This question intended to examine what language was used to teach the course and how this may have affected student success. Questions six centered on how many times the

student repeated this course. Question seven consisted of six reasons why students withdrew

from the course and asked participants to select any which described them. The choices were as

follows:

☐ I did not understand the problems, they were too difficult

☐ I did not understand the Spanish the professor spoke.

☐ I had too much work from other courses

☐ I did not have transportation

☐ I had difficulty translating the English textbook to Spanish

☐ Others_____

This last part of the questionnaire enabled students to feel free to choose more than one

option which varied from course difficulty, language and its effect, or simply lack of

transportation. This part also enabled participants to expand their reply since this method of

questioning also provided an opportunity for them to point out any difficulties they might have

encountered during their first year of university life which can also affect successful completion

of courses at UPRM.

On the days the questionnaires were distributed, students were visited by the investigator

or a trained research assistant. Using a previously written script, students were notified of the

research and were invited to participate by completing the questionnaire. The investigator and/or

assistant clarified the information they provided would be coded for confidentiality and the

information would be published collectively. Participants' confidentiality was safeguarded

throughout this study by using a special four-digit alpha codification which was equivalent to the

last four digits of their student number. They were also informed the information they provide,

although public, will be added in an aggregated manner. The process of introducing the project,

explaining its objective and filling out the questionnaire took approximately five minutes. It was

also made clear to the participants the information gathered from the questionnaire would be kept

under lock and key in the office of the President of the Graduate Committee and would be available for viewing solely by the investigator and committee members. Additionally, we made it clear that upon conclusion of this study, as soon as the thesis is handed in and approved, the questionnaires would be destroyed.

At the end of the three days for completing the data collection, there were a total of 270 participants. Part three of the data collection process was the statistical evaluation of the information provided. Dr. Olgamary Rivera Marrero, Associate Director of the Department of Mathematics reviewed the data, and recommended C. Barreto, who possesses a Master's degree in statistical analysis, and agreed to cross-reference the data, based on a set of variables.

In order to begin the analysis and cross-referencing both the quantitative and qualitative data, I requested information of students whose student number was 802-12-xxxx from OIIP. However, in order to safeguard student privacy, they did not include student names or numbers, and I was asked by OIIP to speak to the Registrar, Mrs. Briseida Meléndez. During this meeting, Mrs. Meléndez reminded me an informed consent was necessary or at least to have students sign the questionnaire after the written statement was announced to indicate their consent. Additionally, I was informed if I had used the original questionnaire and consent form, we could have sent both documents through email and worked with the data from those who participated. The meeting with Briseida Meléndez and Catherine Troche, Director and Associate Director of the Registrars' Office, evaluated the project and the significance of my petition for student information. On September 26, 2013, Briseida Meléndez, Director of the Registrars' office, complying with the requirements of privacy stipulated in the Family Educational Rights and Privacy Act, sent a communication stipulating her decision on the matter and authorized the information using a "dummy number" (Appendix G).

In order to begin the evaluation of the data, those participants with student numbers 802-12-xxxx who were repeating MATE 3171 were set apart. Therefore, the sample includes forty two (42) participants and their responses were examined using descriptive analysis. The following chapter provides the findings of this studying using both the data received from OIIP and the seven-item questionnaire. The findings include an analysis of all the participants, as well as the 42 participants who are the convenient sample described earlier.

Chapter Four: Findings and Discussion

Results Chi-square test #1

The result of the chi-square test performed measures if a relationship exists between the grades obtained in MATE 3171 and the type of high school students attended. This comparison was deemed necessary based on a concern which arose from personal teaching experience and the Mathematics results for seventh and eighth graders during their *Pruebas Puertorriqueñas de Aptitude Académica* or PPAA (outlined in p. 16), but it also keeps in line with the literature concerning the under-preparedness of students, especially in Mathematics and how it affects non-completion of Bachelor's degrees which was consistently explored in the previous Review of Literature (pp. 15-29). Additionally, during the completion of my MA degree, I have been privileged to work alongside scholars at UPRM who are deeply concerned with the results from the public as well as private school system in Puerto Rico, especially in the areas of English, Mathematics and Science, and who work closely with the Department of Education to offer workshops to teachers in these areas of study. Consequently, this type of chi-square test can provide information which may be important to the college and Arts and Sciences in their endeavors to provide assistance to public as well as private schools.

The chi-square test focused on 1,085 first-year students who enrolled in MATE 3171 during 2012-2013. The distribution of students was divided in two groups: Students who passed MATE 3171 and students who did not pass. Table 3 describes the results obtained for this random sample.

Table 7: *Pearson Chi-Square test for relationship between variables: Passing MATE 3171 and type of high school attended*

Type of School		Grade received in MATE 3171			
	Total Students	Passed	%	Did not pass	%
Private	569	327	(57%)	242	(43%)
Public	516	245	(47%)	271	(53%)
Total	1085	572	(53%)	513	(47%)

Note: Pearson Chi-Square = 10.832, DF = 1, P-Value = 0.001

Likelihood Ratio Chi-Square = 10.846, DF = 1, P-Value = 0.001

A significance level of 5%, indicates there is substantial evidence to infer a relationship exists between the type of high school students attend and the final grade received in MATE 3171. Table 7 above, shows that out of 569 students who attended private schools, 327 or approximately 57% passed MATE 3171. We compare this amount to students who derived from the public school system and Table 7 indicates of 516 students who took this course, 245 or approximately 47 % passed the course.

In order to evidence the association between these two variables, Cramer's coefficient is calculated to the square root using Minitab:

Cramer's V-square 0.0099830

As mentioned previously, Cramer's V varies between 0 and 1. Close to 0, the coefficient shows little association between variables. Close to 1, it indicates a strong association. By calculating the square root of the results provided in this test, we find Cramer's coefficient is 0.0999,

which indicates that although a relationship does exist between these two variables, the results

of Cramer's V indicate it is not a strong association.

Results Chi-square test #2

The second chi-square statistical test performed from data obtain from OIIP measures if a

relationship exists between the grade received for UPRM English courses and the type of high

school student attended. The same concerns as outline in Test #1 were considered for English

courses, especially to explore language as a factor for passing MATE 3171.

This chi-square test focused on 1,000 first-year students who enrolled in English courses

during 2012-2013. It is important to note there are students who were not enrolled in English

courses during this time. Also, since UPRM no longer offers Pre-Basic English 0066, we cannot

define whether they were also included in this list of students. The distribution of students was

divided in two groups: Students who passed UPRM English courses and those who did not pass.

Table 8 describes the results obtained for this random sample.

Table 8: *Pearson Chi-Square test for relationship between variables: Grade received in UPRM English courses and the type of high school student attended*

Type of School	Grade received in UPRM English courses				
	Total Students	Passed	%	Did not pass	%
Private	532	497	(93%)	35	(7%)
Public	468	439	(94%)	29	(6%)
Total	1000	936	(94%)	64	(6%)

Note: Pearson Chi-Square = 0.061, DF = 1, P-Value = 0.805

Likelihood Ratio Chi-Square = 0.061, DF = 1, P-Value = 0.805

Table 8 shows of 532 students who attended private schools, 497 or 93% passed their English course at UPRM and 35 or 7% did not pass. In addition, Table 8 shows of 468 public schools students who enrolled in UPRM English courses, 439 or 94% passed the course while 29 or 6% did not pass UPRM English course. The chi-square test #2 performed to find a relationship between UPRM English courses and the type of student attended found, with a significance level of five percent, there does not exist significant evidence to infer a relationship exists between the type of high school students attended and the final grade received in UPRM English courses since the rate of the p-value of 0.805 is greater than our significance level.

Figure 5 demonstrates the distribution of students enrolled in UPRM English courses (3101, 3202, 3103, 3104, 3211 and 3212) who passed MATE 3171 during 2012-2013 school year: it provides a breakdown of each English course provided and the percentage levels of success rate in MATE 3171.

Distribution of students enrolled in UPRM English courses who passed Pre-Calculus I
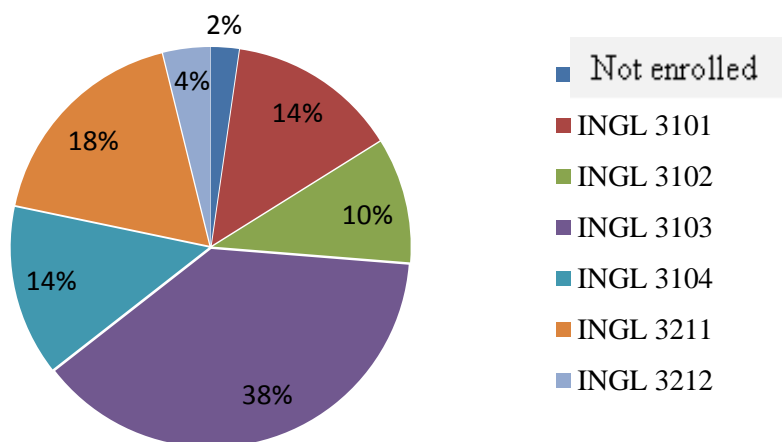
Figure 5. Distribution of students enrolled in English course who passed MATE 3171

In order to examine how language affects student success in passing their Pre-Calculus course, this study highlights which English courses showed greater levels of success in passing MATE 3171. Figure 5 shows the highest averages of students who passed MATE 3171 are from INGL 3103, an Intermediate English course offered at UPRM. Surprisingly, Figure 5 also indicates that among the average of students who passed this math course, INGL 3212, the Advanced English course shows four percent passed MATE 3171 for the 2012-2013 school year. Figure 5 shows that two percent derive from those students who did not enroll in English courses during this school year. These students did not enroll in English for this term or were enrolled in Pre-basic English course elsewhere since UPRM does not offer this course.

When students who enrolled in Basic English courses (3101, 3102) are combined, note that 24 % passed MATE 3171. When the Intermediate English courses (3103, 3104) are combined, note that 52% passed MATE3171 (Figure 5). Finally, of the students who enrolled in Advanced English courses (3211, 3212), 22 % passed MATE 3171. In other words, the distribution of students who passed MATE3171 and their respective English courses, is that the greater number of students who pass MATE 3171 derived from Intermediate English courses, while the lesser average of students who passed MATE3171 derive from Advanced English courses.

**Distribution of student enrolled in English courses
that did not pass Pre-Calculus I**
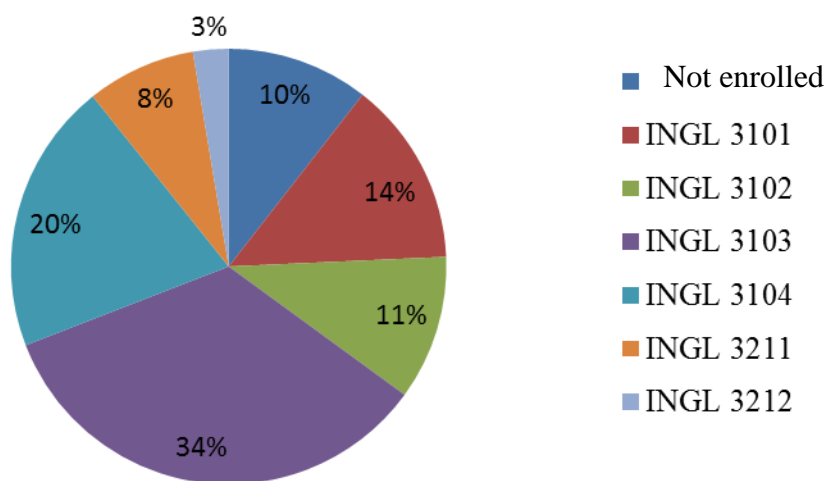
Figure 6. Distribution of student enrolled in English courses who did not pass MATE 3171

In order to study language and its effect on the success rate of MATE 3171, it was also

necessary to outline the distribution of students who did not pass MATE 3171 along with the

English course they enrolled in. Figure 6, outlines the distribution of students who

enrolled in English courses and were not successful completers of MATE 3171. When both Basic

English courses (3101, 3102) are combined, 25% did not pass MATE 3171. Next, the results

from Intermediate English course enrollment (3103, 3104), show that 54% of students who

enrolled did not pass MATE 3171. Finally, of the average of students enrolled in Advanced

English courses (3211, 3212), 11 % did not pass MATE 3171. These two charts, show that

students who enrolled in Basic English courses (3101, 3102) obtained the same passing and

failure averages for MATE 3171 (24% pass; 25% fail, respectively). It is disconcerting to

discover a quarter of students enrolled in Basic English courses pass MATE 3171. Additionally,

the average pass/fail rate for students enrolled in Intermediate English courses also an

approximation (52% pass; 54% fail). These averages are a concern when the charts provided

clearly show over half the students enrolled in Intermediate English do not pass MATE 3171. If

we look at the pass/fail rate for students enrolled in Advanced English courses, we find that

although the rate of failing MATE 3171 has dropped (11%), it is still worrisome when over ten

percent of students who enroll in Advanced English courses do not pass a non-English course.

Results Chi-Square test #3

The following are the results of the third chi-square test which was performed in order to

find if a relationship exists between MATE 3171 and English courses (3101-3102; 3103-3104

and 3211-3212).

Using data provided from OIIP, the chi-square test focused on 1,031 first-year students

who enrolled in MATE 3171 during 2012-2013 and were also enrolled in UPRM English

courses. Again, those students who are not included are those not enrolled in English courses,

during this semester or because they are enrolled in Pre-basic English, elsewhere since UPRM

does not offer it. The distribution was divided in two groups: Students who passed both courses

and students who did not pass. Table 9 demonstrates the results obtained for this sample.

Table 9: *Pearson Chi-Square test for relationships between variables: Passing MATE 3171 and English Courses*

Students enrolled in MATE 3171	Students enrolled in INGL (3101, 3103, 3211)				
	Total Students	Passed	%	Did not pass	%
Passed	556	548	(99 %)	8	(1 %)
Did not pass	475	419	(88 %)	56	(12%)
Total	1031	967	(94%)	64	(6%)

Pearson Chi-Square = 44.677, DF = 1, P-Value = 0.000

Likelihood Ratio Chi-Square = 46.069, DF = 1, P-Value = 0.000

In determining a relationship between grades received in MATE 3171 and how it relates to grades received in English courses for this test, Table 9 shows that out of 1,031 students enrolled in MATE 3171 and also enrolled in English courses, (INGL 3101-02, 3103-04 and 3211-12), 967 or 94% passed English, while 64 or six percent did not pass English. Breaking down this total, out of 556 students who enrolled in and passed MATE 3171, a total of 548 or 99% also passed their English course with only 8 students or one percent who did not pass their English course. Additionally, out of 475 students who did not pass MATE 3171, a total of 419 or 88 % passed their English course, while 56 or approximately 12% did not pass the course. This represents 11 % more students not passing English compared to those who passed MATE 3171.

In deciding whether or not the null hypothesis is rejected, the p-value is generally used. The p-value is the probability that your null hypothesis is actually correct and if this p-value is greater than the significance level of the test (0.05) which is the usual level (or alpha level) chosen, then the Ho hypothesis is not rejected. If instead the p-value is less than 0.05, the Ho

hypothesis is rejected and it is concluded that there exists no dependence.

Since the value of the p-value of this test is less than our level of significance of five percent, we find there is significant evidence to infer there exist a certain relationship between the results obtained in the UPRM English courses and the final grade obtained in the MATE 3171 course. With a P-value of 0.000, the result of the chi-square test as shown in Table 9, demonstrates significant evidence to reject Hypothesis "Ho" which states there does not exist a relationship with variables X and Y. In other words, the chi-square test determined there is a relationship between the grades received in MATE 3171 and grades received in their English courses. In order to measure the validity of the relationship between these two variables we used Cramer's coefficient. Using the program, Minitab, we calculated the following:

Cramer's V-square: 0.0457188

As a result, Cramer's coefficient for these two variables is 0.2138 which indicates although a relationship exists between these two variables, the association is not strong.

Results from questionnaire

The data collection for the qualitative portion of this study was completed using a seven-item questionnaire which was developed to meet with the objectives of the study. A total of 270 students participated in this study and of this total, 156 or 57.7% indicated they were not repeating MATE 3171; while 107 or 39.6% replied they were repeating the course. Five participants responded they were repeating the course after failing MATE 3005 and one participant did not provide an answer to the question. In order to focus on students who were repeating the course, out of 107 participants who stated they were repeating the course, we chose only those participants whose student number began with 802-12-xxxx in order to examine the

2012 cohort. As a result, 42 or 16% of this population will hereafter be considered as the sample

used for this portion of the study. The following is an analysis from this questionnaire.

Table 10: *Question 2- Have you studied in a bilingual school?*

Have you studied in a bilingual school?			
Yes		No	
24 (57%)		18 (43%)	
Grade Level			
Elementary	Elementary-Intermediate	Intermediate-High School	All
5 (21%)	1 (4%)	3 (13%)	15 (63%)

In order to evaluate language issues for the 42 participants used in this part of the study,

Table 10 presents a breakdown of responses as to whether or not students attended a bilingual

school. Out of 42 students asked, 24 or 57% replied they had been enrolled in bilingual schools.

Table 10 also demonstrates from the 24 students who attended bilingual schools, 15 or 63%

attended from elementary to high school levels. To break down the remaining replies, 5 students

or 21 % attended elementary, one student or 4% attended elementary through intermediate and 3

or 13 % attended bilingual schools from intermediate to high school levels. That is, of the 42

participants, Table 6 indicates the majority attended bilingual schools across all grade levels.

This information is useful because it shows the greater part of the sample in this study have

received English instruction at some point before entering UPRM, and in fact, the majority has

received English instruction for all grade levels before entering the university.

Question 3 was also targeted at learning students' take on the usefulness of English for all

UPRM courses. By using a Likert scale, participants could rate the questions by choosing

numbers one (of little use) to ten (very useful). Table 11 provides an outline of responses offered

by students.

Table 11. *Question 3 - How useful has the English you learned in secondary school been for your UPRM courses?*

	Likert Scale (Rating 1-10)										
	0	1	2	3	4	5	6	7	8	9	10
	Student responses										
f	1	1	3	3	0	3	4	2	7	4	14
%	2.4	2.4	7%	7%	0	7%	10%	5%	17%	10%	33%

Note: One student indicated *zero* (0) as his/her score

According to Table 11, of the 42 students questioned, 14 or 33% rated the English they had learned in high school as very useful. If we accumulate students' ratings from 5 to 10, a total of 34 students or 81% consider the English they learned in high school to be useful in all UPRM courses. Likewise, if we accumulate students' ratings from 1 to 3 (no student checked a 4), then a total of seven students or 17% rated the English they learned in high school to be of little use for all UPRM courses. Note that one student provided a rating of zero. As a result, the majority of students from this sample consider the English they learned in high school as useful in all UPRM courses.

As we continue to examine language as it pertains to academic success in MATE 3171, Question 4 asked participants to rate the usefulness of the English they learned in high school for their MATE 3171 course. Table 12 outlines students' responses.

Table 12. *Question 4- How useful has the English you learned in secondary school been for your*

Pre-calculus course (MATE 3171) at UPRM?

	Likert Scale 1-10										
	0	1	2	3	4	5	6	7	8	9	10
				Student response							
f	2	10	5	3	3	4	2	3	3	0	7
%	5%	24%	12%	7%	7%	10%	5%	7%	7%	0	17%

Note: Two students indicated *zero* (0) as his/her scores.

     Part of the objectives of this research was to study how students perceive the usefulness English in been for MATE 3171, and Question 4 was posed in order to discover this, especially since it pertains to successful completion of the course. Table 12 reflects their responses. In this instance, out of 42 students asked, seven students or 17% answered the English they learned was useful during their Pre-Calculus I. Similar to how question 3, if we add students' responses from five to ten (5-10 representing usefulness) on the Likert Scale, a total of 19 or 45% of students replied that the English they learned in high school was useful for MATE 3171. On the other hand, a total of 21 or 50% rated the English they learned in high school was not useful for this course. Furthermore, two students or five percent replied zero (0) or below the actual score in their rating. (Zero was not an option provided on the Likert Scale.)

     What stands out from these two ratings is the varied set of values applied in student responses, including those participants who scored Question 3 with a 10. Surprisingly, three students or seven percent went from ten to five and minus one on the Likert Scale. The following two graphs shown side by side indicate this difference.
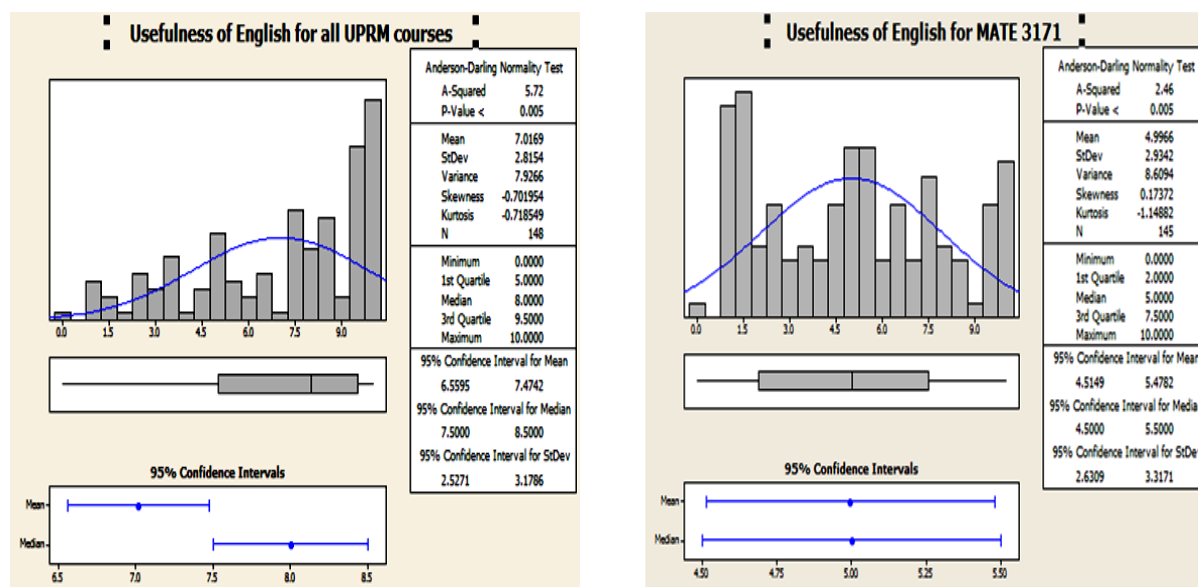
Figure 7. Comparing sets of value for ratings applied in Questions 3 and 4

As demonstrated in Figure 7, there is a shift in students' responses regarding the issue of language and its usefulness in all UPRM courses versus how useful the English they learned in high school has been for their MATE 3171course. Figure 7 above shows there is a definite change in the sets of values in students' perception from questions 3 and 4, which are clearly evident in these two graphs. Unfortunately, the questionnaire did not provide a space to follow up with an opened answer question as to why they chose their ratings. Perhaps English was not needed because numbers are a universal language and mathematics deal with numbers and problems solving. It is still my contention though, since the objectives of this study were clearly explained to the participants prior to answering, they understood questions 3 and 4 to be the use of language within the area of successful completion of the course. This information is useful because it shows the greater part of the sample used in this study have received English instruction at some point before entering UPRM, and in fact, the majority has received English instruction for all grade levels and subject matters before entering the university.

Question 5 continues to view language as a factor for high withdrawal levels in MATE3171. It was important to receive student responses on the language which the professor used to offer the course; 41 or 99% replied their professors offered the class in Spanish. Only one student answered the class was offered in English. The objective of this study was to examine the areas in which language played a part in high withdrawal rates and non-passing grades. Since the textbook and some subject materials are given in English, it was also important to investigate which language was used as well. The replies did establish Spanish is primarily the language used to offer MATE 3171.

For years just as the literature offered attests to, the withdrawals and non-passing grades for this course have been a source of concern for the Department. Question 6 therefore, seeks to evaluate how many times students have repeated the course since enrolling in 2012. From the 42 participants who replied, 34 or 81% of these students had enrolled in this course twice since their first year at UPRM while eight students or 19% had enrolled for the first time. Again, it is unsettling to observe how students, who have repeated this course twice already, will probably have to take once more. Unfortunately, because of Registrars' decision not to include student numbers in their data, I was not able to cross reference in order to confirm if students from this sample passed or failed the course.

The last question provided in the questionnaire gave students the option of more than one choice of reasons why they withdrew from the course. In addition, it supplied a section marked, "other," which allowed them to indicate any difficulties they have faced during their first year which might have also affected their successful completion of courses at UPRM. Table 13 breaks down students' responses.

Table 13. *Question 7: Reasons for withdrawing:*

	Total Student replies	Did not reply
	9 (21%)	33 (79%)
Answer Choices	Distribution of responses	
I did not understand the problems, they were too difficult	8 (89%)	
I did not understand the Spanish the professor spoke	1 (11%)	
I had too much work from other courses	5 (56%)	
I did not have transportation	0	
I had difficulty translating the English textbook to Spanish	1 (11%)	
Other:	4 (44%)	
Raise grade or average	2 (22%)	
The teacher explained too fast	2 (22%)	

Note. Four students replied in combination: (three students: 1 and other; one student: 1, 3 and other.

The last question in the questionnaire asked students to supply one or more reasons why they decided to withdraw from MATE 3171. Table 13 demonstrates out of 42 students who, only nine or 21% answered this part of the questionnaire with 33 or 79% who did not reply. For those who participated, eight students or 89% chose, "I did not understand the problems, they were too difficult." This option was picked the most for this sample. Another choice students picked was,

"I had too much work from other courses," with five or 56% choosing this option. The third

option chosen regularly was "Other," in which students posed their reasons other than the

choices provided. In this portion, four students or 44% participated in this part of Question 7,

choosing this option alone or in combination with other choices provided. We received varied

replies, but the one chosen the most, with two students or 50% of those which chose "other"

indicated they withdrew in order to raise their grade. Two students or 50% of the sample who

indicated "Other" chose, "the professor explained too fast." As the results shown in Table 13

indicate, the majority of those students who answered this portion of the questionnaire point out

they withdrew from MATE 3171 because they did not understand the problems and found them

too difficult, they had too much work from other course, they withdrew in order to raise their

grade average and the professor explained too fast. It is important to note, however that one

student chose, from the options provided in the questionnaire, option five or that he/she had

difficulty translating the English textbook to Spanish. Again this aligns with the problem of

translating the textbook as mentioned in the Review of Literature (pp. 15-29).

This study contends although students may not have directly indicated language as their

reason for withdrawing from MATE 3171, the varying sets of values provided for Questions 3

and 4 (Figure 7) is an indicator of students' perception of English as it applies to successful

completion of this course and requires a higher level of consideration by the Department of

Mathematics at UPRM. Table 13 indicates out of the choices why students decided to withdraw,

eight students or 89 % indicated they withdrew because they did not understand the problems.

This information, combined with the varied sets of values from questions 3 and 4 should also

concern the Department of Mathematics in their efforts to increase retention for Pre-Calculus I.

The following chapter will bring this research to a close, summarizing the results found

and discussing whether or not the goals set forth during this study were met. Given all the

setbacks encountered during this process, this chapter also outlines the limitations of this study

as well as setting forth recommendations which can be of assistance to those interested in

working with student retention and completion.

Chapter Five: Conclusion

Research question #1: Is there a relationship between English proficiency and academic performance in MATE 3171?

The objective of this study was to examine to what extent language was a determining factor in the withdrawal and/or non-passing grades in Pre-calculus I. The results in both the quantitative as well as the qualitative parts of this study show English as an underlying factor as the reason for the high withdrawals and/or non-passing grades in Pre-calculus I.

Question #2: Is there a relationship between the grade received in MATE 3171 and the type of high school student attended?

The results of chi-square test #1 as shown in Table 7 (p.46) show there is substantial evidence to infer a relationship exists between the grade received in MATE 3171 and the type of high school student attended, demonstrating that students from private schools pass the course (58%), while students from public schools pass at a lower rate (48%).

Question #3: To what extent English language proficiency plays a role in students' difficulty in passing Pre-Calculus I?

In contrast, the results from the chi-square test #2, as shown in Table 8 (p.48) for relationship between variables: Grade received in UPRM English courses and the type of high school student attended demonstrates, with a significance level of five percent, there does not exist significant evidence to infer a relationship exists between the type of high school students attended and the final grade received in UPRM English courses since the rate of the p-value of 0.805 is greater than our 5.0 significance level established for this test.

Finally, the results of the chi-square test #3 as shown in Table 9 (p. 52) demonstrate, with a level of significance of five percent, there exists a certain relationship between passing or failing both Pre-calculus I and English courses and it clearly demonstrates that students who pass their Pre-calculus I courses also tend to pass English.

The chi-square test #2 performed to find a relationship between UPRM English courses and the type of student attended found, with a significance level of five percent, there does not exist significant evidence to infer a relationship exists between the type of high school students attended and the final grade received in UPRM English courses since the rate of the p-value of 0.805 is greater than our significance level.

Question #4: How do students perceive the usefulness of English in Pre-Calculus I and the extent which is needed to understand the textbook and additional materials in the course?

Participants' replies in the seven–item questionnaire, where they were asked about the English they learned in high school and how it helped in Pre-calculus I, the study also demonstrated 19 or 45% of students replied the English they learned in high school was useful for Pre-calculus I. In contrast, a total of 21 or 50% rated the English they learned in high school was not useful for this course. In addition, two students or five percent of this sample replied with a zero (0) which was below the actual score in their rating. In all fairness in which we have looked at this matter from the beginning, it is important to clarify that since we did not ask a follow up question, "Why," in order to receive more feedback on Questions 3 and 4, no conjectures can be made because scholars within the Department of Mathematics have mentioned that students who answered this item might have interpreted language as not useful since these students were able to understand the numbers provided, and may not have needed English in order to understand the problem. I argue this last point because students were

provided with an explanation of the objectives of this study prior to handing the questionnaire. Additionally, it is important to draw attention to concerns made by Dr. Damaris Santana, who claims a number of her Latin American students had trouble, especially during their first year due mostly to their literal translations of the textbook. We must consider these students, although they were not part of the study, especially since some might have provided workshops in Pre-calculus I. Cramer's coefficient completed in the chi-square test shown in this study did not indicate that a strong relationship exists with English and Pre-calculus I, however a certain relation does exist which requires further study.

During a meeting with Dr. Olgamary Rivera, in her capacity as Associated Director of the Department of Mathematics, she outlined a few problems with Pre-calculus I which might be in direct consequence to the number of withdrawals and/or non-passing grades of Pre-calculus I. One of these factors is not enough training for the teaching assistants. Unfortunately, a number of these potential graduate students do not have any teaching training. Pang (2010) mentions that to succeed in retention and completion of university degrees, besides having smaller groups, one very important factor is having trained and competent teachings assistants who are closely supervised (Strengthen Math Education…, para. 5). Dr. Rivera agrees there should be a training course for teaching assistants, prior to proving workshops in Pre-calculus I so they are not overwhelmed with the objectives they propose to students. Secondly, some of these teaching assistants offer class in an amphitheatre and, according to Dr. Rivera and this is also not advisable. This comment aligns with some of the replies offered in the questionnaire, where students mentioned not enough ability to explain by the professor. The department has looked into this matter and has allowed teaching assistants to offer only the workshops. Again, Dr. Olgamary Rivera points at the serious efforts involved in this decision, commenting how most of

these teaching assistants have no experience in offering workshops. To this point, she stresses the importance of presenting a seminar on providing training workshops. Dr. Rivera also expressed her concern those students from Latin-American countries and how they have to handle and settle their visa issues. These students sometimes arrive to Puerto Rico days before the courses begin without the required backup of a seminar to guide them again, this is due to circumstances beyond their control. In this case, my recommendation to Dr. Rivera was to conduct these trainings through Skype conferences in order to offer the seminar to all students before the academic semester begins preferably during the summer.

Along the lines of language concerns, we cannot ignore how, if these Latin-American students who offer workshops are themselves having trouble with the translation of the textbook, and given that the discourse used in Puerto Rico differs from that spoken in their country of origin, these factors may also contribute to the language issue and successful completion of Pre-calculus I. As for the course itself, Dr. Olgamary Rivera was approached on the possibility of the department to redact a textbook, using terminology which would be employed both by professors and teaching assistants. During our meeting, Dr. Rivera showed me the first edition of this textbook, commenting the need to continue improving it.

Limitations of Study

During the course of this study, there were a number of setbacks which affected the ongoing investigation and which played a significant role in the final results of the research. The IRB's original decision that the questionnaire and informed consent was to be handed personally and not through the use of email, delayed the original investigation. We later discovered it could have been sent via email. This would probably have given us a greater participation. Also, the IRB committee's determination that this study was within normal educational practices brought

about within an academic context and therefore exempt of all requirements, including the use of

an informed consent which kept us from receiving permission to acquire student numbers which

were necessary to cross reference data from the questionnaire and data from OIIP in order to

create a stronger analysis of the sample. Due to these setbacks, I propose a higher and more

effective communication between departments in charge of protecting students' rights and

privacy. During this study, my committee worked with utmost integrity and respect for students'

needs, and it would have been beneficial and less time consuming if both the IRB and Registrars'

offices had created clear lines of communication which would help to advise future investigators

of the proper protocol to employ when dealing with students as participants, thus save time.

After receiving final approval to conduct this study, Dr. Pedro Vasquez Urbano,

Coordinator of MATE 3171 allowed entry to workshops and this had a huge effect on the amount

of participants due to high absenteeism in workshops in contrast to the actual classes. Also,

limiting the data collection to only the last eight minutes of the class in order to hand out and

collect the questionnaires created a problem. Since this time was cut short because the workshop

was extended and so the investigator or assistant had to ask students for a little patience and time

in order to fill out the questionnaire. As a consequence, many participants left or did not

complete the questionnaire, especially when they confronted the first question: if they were

repeating the course, and then asked their reasons for withdrawing from the course.

Recommendations for further research

Tinto (2002) suggests, in order to create an effective change to increase student retention,

the efforts by the learning institutions, "...must be seen as part and parcel of institutional

educational functioning, a responsibility that is shared by all members of the institution, in

particular the faculty." (p. 5) He suggests two areas which can be explored; "...the effects of

classroom practice upon student learning and persistence and the impact of institutional

investment in faculty and staff development programs on those outcomes" (p. 7). After

completing the data collection for this study at the Department of Mathematics, it was called to

my attention that instructors who provided workshops in this department (including Pre-calculus

I) contacted the Associate Director and requested a Conversational English Course. This request

is considered to be a good start because it complements both English and Mathematics and may

assist in providing a better understanding of the English used in the textbook. This was one of the

concerns posed in this study, especially for Latin-American students who literally translated the

math problems in the text book. I also suggested that a textbook be developed by the UPRM

Department of Mathematics for MATE 3171 in which there is collaboration from a

representative group of faculty members so the language can be targeted and coherent with the

terminology used by the professors and instructors in math. As stated earlier, Dr. Olgamary

Rivera stated this option has been written and continues being refined to furnish students' needs.

Also, there is a need to design seminars for teaching assistants in order to guide them through the

teaching process and propose strategies which will be useful both in the classes they offer, as

well as their own academic responsibilities. As mentioned previously, several Skype conferences

are a viable solution for those students who have difficulty arriving to the island weeks before

classes begin since this is an excellent option to provide seminars and clarify many doubts.

Finally, instead of using a punitive system in order to deal with the high withdrawal rates, UPRM

should become more proactive and formulate strategies and programs designed to find solutions

to enhance retention rates.

This study demonstrated a relationship between language and passing Pre-calculus I and

further studies should be carried out using a longitudinal approach to acquire more and expanded

quantitative and qualitative data. Having had setbacks as far as cross-referenced data due to lack

of proper procedures, further studies can be completed complying with all requirements to

protect student privacy laws, and at the same time, having the necessary information in order to

have more and complete data. Consequently, the Department of Mathematics needs to

investigate further and share this information with other departments to provide opportunities

and resources to examine this phenomenon at an institutional level.

In conclusion, one way of seeing the withdrawal and non-passing grades problem at

UPRM, specifically in Pre-calculus I, is to understand why students withdraw. Although

quantitative data is readily available, a sound qualitative research can probe deeper to

complement the results of this study. However, it is even more crucial to explore how institutions

can help students stay and succeed in completing their degrees.

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Appendices

Appendix A: Speaking English in Puerto Rico

| Clipboard | Font | Alignment | Number | Styles |

A2 | fx | Table 41. Detailed Languages Spoken at Home and Ability to Speak English for the Population 5 Years and Over for Puerto Rico: 2006-2008

	A	B	C	D	E	F	G	H	I	J	K
2	Table 41. Detailed Languages Spoken at Home and Ability to Speak English for the Population 5 Years and Over for Puerto Rico: 2006-2008										
3	Release Date: April, 2010										
4		Number of speakers	Margin of Error[1]	Spoke English less than "Very Well"	Margin of Error[1]						
5	**Population 5 years and over**	3,695,811	15	3,000,975	8,597						
6	Spoke only English at home	174,269	4,581	(X)	(X)						
7	Spoke a language other than English at home	3,521,542	4,577	3,000,975	8,597						
8	**Spoke a language other than English at home**	3,521,542	4,577	3,000,975	8,597						
9	SPANISH AND SPANISH CREOLE	3,517,228	4,703	2,998,937	8,602						
10	Spanish	3,517,228	4,703	2,998,937	8,602						
11	OTHER INDO-EUROPEAN LANGUAGES	3,176	532	1,222	307						
12	**French**	1,047	283	237	101						
13	French	1,047	283	237	101						
14	**French Creole**	173	146	27	46						
15	**Italian**	499	197	177	94						
16	**Portuguese**	662	258	476	234						
17	Portuguese	662	258	476	234						
18	**German**	435	224	160	114						
19	German	435	224	160	114						
20	**Yiddish**	44	50	(B)	--						
21	**Other West Germanic languages**	22	26	(B)	--						
22	Dutch	22	26	(B)	--						
23	**Scandinavian languages**	68	99	68	99						
24	Swedish	68	99	68	99						
25	**Greek**	31	51	(B)	--						

◄ ► ... | MN | MO | MS | MT | NC | ND | NE | NH | NJ | NM | NV | NY | OH | OK | OR | PA | **PR** | RI | SC | SD | TN | TX | UT | VA | VT

READY

Appendix B: IRB Approval

Comité para la Protección de los Seres Humanos en la Investigación
CPSHI/ IRB 00002053
Universidad de Puerto Rico – Recinto Universitario de Mayagüez
Decanato de Asuntos Académicos
Call Box 9000
Mayagüez, PR 00681-9000

21 de diciembre de 2011

Sa. Ivette Delgado Rivera

Estimada Sa. Delgado Rivera:

El Comité para la Protección de los Seres Humanos en la Investigación (CPSHI) ha considerado la Solicitud de Revisión corregida para su proyecto titulado *Withdrawal and Non-passing Grades in UPRM Precalculus I: What's Language Got To Do With It?* así como también la hoja de Consentimiento Informado y el Cuestionario.

Habiendo constatado que ha incorporado todas las observaciones que se le hicieron, el comité aprueba su investigación. Esta aprobación es válida por un año, comenzando el día de hoy, 21 de diciembre de 2011, hasta el 20 de diciembre de 2012. Cualquier cambio a la investigación deberá notificarse de inmediato al comité.

Hemos notado que su investigación es por un periodo de dos años. Le rogamos que, con aproximadamente un mes de anticipación, solicite una renovación, la cual es casi automática, si no han surgido problemas inesperados.

Le deseamos éxito en su investigación y aprovechamos la ocasión para desearle una muy feliz Navidad. Queda de usted,

Atentamente,

Rosa F. Martínez Cruzado, Ph.D.
Presidente
CPSHI/IRB – RUM

Teléfono: (787) 832 - 4040 x 3196, 3807, 3808 – Fax: (787) 831-2085 – Página Web: www.uprm.edu/cpshi
Email: cpshi@uprm.edu

Appendix C: IRB Modification Notice

Comité para la Protección de los Seres Humanos en la Investigación
CPSHI/IRB 00002053
Universidad de Puerto Rico – Recinto Universitario de Mayagüez
Decanato de Asuntos Académicos
Call Box 9000
Mayagüez, PR 00681-9000

6 de febrero de 2013

Profa. Ivette Delgado Rivera

Estimada Profesora Delgado Rivera:

En su reunión del viernes, 1^{ero} de los corrientes, el Comité para la Protección de los Seres Humanos en la Investigación (CPSHI) consideró la documentación sometida para el proyecto titulado *Withdrawal and Non-passing Grades in UPRM Precalculus I: What's Language got to do with it?*

Este estudio se limita a prácticas educativas normales, llevado a cabo en el contexto de la academia. Por esta razón, el CPSHI ha determinado que este estudio, bajo la cláusula 45 CFR 46.101(b)(1), está exento de todos los requisitos, incluyendo el del consentimiento informado.

Cualquier cambio al protocolo aprobado deberá ser revisado y aprobado por el CPSHI antes de su implantación. El CPSHI deberá ser informado de inmediato de cualquier queja sobre esta investigación y de cualquier violación a la confidencialidad de los participantes.

Agradecemos su compromiso con los más altos estándares de protección de los seres humanos y le deseamos éxito en su investigación.

Atentamente,

Rosa F. Martínez Cruzado, Ph.D.
Presidente
CPSHI/IRB – RUM

Teléfono: (787) 832 - 4040 x 3196, 3807, 3808 – Fax: (787) 831-2085 – Página Web: www.uprm.edu/cpshi
Email: cpshi@uprm.edu

Appendix D: Seven-item Questionnaire
(Spanish Version)

Cuestionario   Codigo_____

Instrucciones: Complete las siguientes preguntas lo más específicamente posible. Recuerde

que este estudio es confidencial. Sus respuestas serán consideradas como parte de un grupo y

no individualmente. No hay respuestas correctas o incorrectas.

1. ¿Está usted repitiendo este curso de Mate 3171?

_____ Sí   _____ No

Nota: Si está tomando MATE 3171 por primera vez, su participación termina aquí. Gracias.

Parte I. Información sobre su inglés

2. ¿Ha estudiado usted en una escuela bilingüe? _____ Sí   _____ No

Marque todas las que apliquen: □ elemental   □ intermedia   □ superior   □ otra _____

3. ¿Cuán útil ha sido el inglés que usted aprendió en su escuela superior para sus cursos en

UPRM?

(Poco) |___|___|___|___|___|___|___|___|___| (Mucho)

                  1   5   10

4. ¿Cuán útil ha sido el inglés que usted aprendió en su escuela superior para su curso de

Pre-calculo (MATE 3171) en UPRM.

(Poco) |___|___|___|___|___|___|___|___|___| (Mucho)

                  1   5   10

Parte II. Información académica sobre MATE 3171

5. ¿Qué idioma utilizó su profesor anterior para ofrecer el curso MATE 3171?

□ Inglés   □ Español   □ Ambos

6. ¿Cuántas veces se ha matriculado este curso?

□ 1   □ 2   □ 3   □ 4   □ Otro_____

7. Si usted se dio de baja, seleccione todas las razones que aplique:

□ No entendía los problemas, eran muy difíciles

□ No entendía el español que hablaba el/la profesor(a)

□ Tenía demasiado trabajo con otros cursos

□ No tenía transportación

□ Se me hacía difícil traducir el texto de inglés a español

□ Otros   ! Gracias por su participación!

Student Number: _____   Code: _____

Questionnaire (English Version)

Instructions: Complete the following questions as specifically as possible. Remember this study is confidential. Your answers will be considered as part of a group and not individually. There are no right or wrong answers.

1. Are you repeating the course, Mate 3171?

_____ Yes   _____ No

Note: If you are taking MATE 3171 for the first time, your participation ends here. Thank you.

Part I. Information pertaining to your English use

2. Have you studied in a bilingual school? _____ Yes   _____ No

Mark all which apply: □ elementary   □ intermediate   □ secondary   □ other _____

3. How useful has the English you learned in secondary school been for your UPRM courses?

(Of little use) |___|___|___|___|___|___|___|___|___| (Very useful)

                 1   5   10

4. How useful has the English you learned in secondary school been for your course, Pre-calculus (MATE 3171) at UPRM.

(Of little use) |___|___|___|___|___|___|___|___|___| (Very useful)

                 1   5   10

Part II. Academic Information concerning MATE 3171

5. Which language did your previous professor use to offer the course MATE 3171?

□ English   □ Spanish   □ Both

6. How many times have you enrolled in this course?

□ 1   □ 2   □ 3   □ 4   □ Other_____

7. If you withdrew, select all the reasons which apply:

□ I did not understand the problems, they were too difficult

□ I did not understand the Spanish the professor spoke.

□ I had too much work from other courses

□ I did not have transportation

□ I had difficulty translating the English textbook to Spanish

□ Other_____

Appendix E: Permission Request to Mathematics Department

14 de febrero de 2013

Dr. Omar Colón, Director
Universidad de Puerto Rico en Mayagüez
Facultad de Artes y Ciencias
Departamento de Matemáticas
Call Box 9000
Mayagüez, Puerto Rico 00681-9018

Asunto: Proyecto de Maestría titulado: *Withdrawal and non-passing grades in UPRM Precalculus I: What's language got to do with it?*

Estimado Doctor Colón:

Soy estudiante graduada del Departamento de Inglés trabajando en mi proyecto de tesis relacionado a estudiantes de Mate 3171. Intereso investigar si el idioma es un factor para que haya un alto número de estudiantes que tienen que repetir el curso.

Los doctores Damaris Santana y Wolfgang Rolke revisaron mi propuesta y sugirieron que utilizara los estudiantes del semestre 2012-2013 como participantes en este estudio, ya que complementaría los datos históricos que estamos analizando. Para fines de cumplir con los requisitos institucionales y debido a que este proyecto involucra estudiantes, solicité permiso del IRB. Luego de la revisión de mi proyecto el 1 de febrero de 2013, el comité determinó que el mismo no requiere permiso del comité ya que lo consideran un estudio normal de academia. Le adjunto copia de su carta. Además, adjunto una lista de las secciones de los talleres de Mate 3171 que obtuve del sistema de matrícula a los cuales intereso visitar.

Por este medio solicito respetuosamente que me permita tomar los primeros 5 minutos de un lunes, martes y miércoles de febrero para recopilar los datos que necesito para completar este estudio. Agradeciendo su atención y ayuda con este estudio de investigación, quedo

Atentamente,

Ivette Delgado Rivera
Candidata a Maestría en Educación en Inglés

CC: Dra. Rosa I. Román Pérez

Anejo:
        Dra. Carta Rosa F. Martínez-Cruzado, Presidenta
        Comité para la Protección de los Seres Humanos en la Investigación
        Lista de Secciones de MATE 3171 para enero 2011

Appendix F: Original Questionnaire

Universidad de Puerto Rico en Mayagüez
Facultad de Artes y Ciencias
Departamento de Inglés

Hoja de Consentimiento Informado al Participante

Me llamo Ivette Delgado y te invito ser parte de una investigación que estoy llevando a cabo para mi tesis de Maestría titulada: *Bajas y notas deficientes en UPRM Pre-cálculo I: ¿Qué tiene que ver el lenguaje con esto?*

Requiero como parte de este estudio, recopilar información de estudiantes que entraron a UPRM como estudiantes de primer año y se matricularon en Pre-Cálculo I (MATE 3171), durante el primer semestre del 2010 y que se dieron de baja del curso o recibieron una nota de D o F. La investigadora coleccionará datos de dos fuentes: una, a través de la institución y la otra es información ofrecida por estudiantes a través de un cuestionario que contestarán voluntariamente. Se analizarán algunos factores que puedan estar relacionados a la alta cantidad de notas bajas (aproximadamente 60%) y la baja retención de este curso. Este cuestionario tomará alrededor de 25 minutos para completar. La siguiente información te detalla lo que se requiere para llevar a cabo esta investigación contigo como participante:

He sido orientado(a) acerca del propósito de la investigación y he podido hacer preguntas sobre mi participación, la cual es voluntaria y completamente anónima. Se me ha informado que puedo rehusar participar o retirarme en cualquier momento del estudio sin penalidad alguna y la información que haya brindado no será utilizada para propósitos ajenos a esta investigación. Entiendo que los datos obtenidos a través del cuestionario pueden ser publicados sólo de manera agregada. Este instrumento será codificado por la investigadora y nadie verá mi nombre. Mientras se lleve a cabo la investigación, los datos permanecerán bajo llave en una oficina. Luego de terminado el estudio, serán destruidos.

Entiendo que no seré sometido a ningún tipo de sufrimiento ni daños físicos y/o mentales como consecuencia de este estudio. Tampoco se me otorgará ningún tipo de incentivo o remuneración por mi participación.

Espero que este estudio sirva para mejorar el desempeño académico y ayude aplacar las tendencias de bajas (W) y/o notas deficientes (D o F) en este curso. Su participación en este estudio es altamente apreciada. Si tienes alguna duda, preocupación, o recuerda alguna otra información que desee comunicarme, puede contactarme al número 787-280-0556 o a mi correo electrónico: ivette.delgado@upr.edu. Le agradezco su participación.

_____   _____
Ivette Delgado Rivera, Candidata de Maestría   Firma del participante

Fecha:_____   Codificación :_____

Cuestionario

Instrucciones: Complete las siguientes preguntas lo más específicamente posible. Recuerde que este estudio es confidencial. Sus respuestas serán consideradas como parte de un grupo y no individualmente. No hay respuestas correctas o incorrectas

Parte I. Información demográfica

1. Edad:_____

2. Género: □ Masculino □ Femenino

3. Lugar de nacimiento: □E.E.U.U._____ □P.R._____ □otro_____

Parte II. Información académica

4. ¿En qué departamento entró en su primer año? _____

5. ¿En qué departamento estudia actualmente? _____
6. Año de estudio_____

7. ¿Cuál fue el primer curso de inglés que tomó en UPRM?

□ Pre-básico (Ingl 0066) □ Básico (Ingl 3101-3102)

□ Intermedio (Ingl 3103-3104) □ Avanzado (Ingl 3211-3212)

8. ¿Marque el tipo de escuela superior a la que usted asistió?

□ pública □ privada □ ambas □ otra _____

9. ¿Cuán útil ha sido el inglés que usted aprendió en su escuela superior para sus cursos en UPRM?

(Poco) |___|___|___|___|___|___|___|___|___| (Mucho)
　　　　　1　　　　　5　　　　　　10

10. ¿Cuán útil ha sido el inglés que usted aprendió en su escuela superior para su curso de Pre-calculo en UPRM.

(Poco) |___|___|___|___|___|___|___|___|___| (Mucho)
　　　　　1　　　　　5　　　　　　10

Parte III. Preguntas demográfica sobre su uso de inglés

11. ¿Qué idioma utiliza usted más en su casa?

□ Inglés □ Español □ Ambos, inglés y español □ Otro _____

12. ¿Qué idioma utiliza usted más con sus amistades?

□ Inglés □ Español □ Ambos, inglés y español □ Otro _____

13. ¿Qué idioma utiliza usted más en sus estudios?

□ Inglés □ Español □ Ambos, inglés y español □ Otro _____

Parte IV. Información académica sobre MATE 3171

14. ¿En qué idioma es el texto de MATE 3171?

□ Inglés □ Español

15. ¿Qué idioma utiliza el profesor para dictar el curso MATE 3171?

□ Inglés   □ Español   □ Ambos

16. ¿Si su profesor se comunica a través del correo electrónico, que idioma utiliza?

□ Inglés   □ Español   □ Ambos

17. ¿En qué idioma se ofrecen los exámenes? (Si aplica)

□ Inglés   □ Español   □ Ambos

18. ¿Proveyó su profesor materiales suplementarios durante este curso?

□ Si ¿en qué idioma?_____   □ No

19. ¿Cuánto inglés usted necesita saber para entender el libro de texto utilizado en su curso de MATE 3171?

(Poco) |___|___|___|___|___|___|___|___|___| (Mucho)
        1   5   10

20. ¿Cuánto inglés usted necesita para entender los materiales adicionales de este curso? (Si aplica)

(Poco) |___|___|___|___|___|___|___|___|___| (Mucho)
        1   5   10

21. ¿El hecho de que la clase sea en inglés y los exámenes en español hace diferencia? (Si aplica)

□ Si   □ No

22. ¿Cuántas veces ha matriculado este curso?

□ 1   □ 2   □ 3   □ 4   □ Otro_____

23. ¿Qué nivel de dificultad tiene este curso para usted?

□ a. No muy fácil

□ b. Fácil

□ c. Difícil

□ d. Muy difícil

24. Si usted contestó c o d, por favor indique que áreas de este curso fueron difíciles para usted.

_____

25. ¿Qué le preocupa sobre este curso?

Parte V. Preguntas sobre la decisión de darse de baja de MATE 3171

Instrucciones: Escoja la respuesta que mejor aplique a su caso.

26. ¿Cuándo se dio de baja de MATE 3171?

        □ antes del primer examen.

        □ después del primer examen.

        □ en el último día de baja.

27. ¿Se comunicó con el profesor/instructor antes de darse de baja?　　　□Sí_____　　　□No_____

28. ¿Asistió a los servicios de tutorías? (Monzón 220)

        □ Sí. ¿Cuántas veces? _____　　　　　　□ No. ¿Por qué?

29. ¿Se comunicó con su orientador?

        □ Sí. ¿Cuántas veces? _____　　　　　　□ No. ¿Por qué?

30. ¿Por qué se dio de baja del curso de Mate 3171?

31. ¿Se dio de baja de algún otro curso de prepa? ¿Cuál?_____

32. ¿Por qué se dio de baja es este otro curso?

33. ¿Se comunicó con el orientador antes de tomar esta decisión?

        □ Sí.　　　　　　□ No. ¿Por qué?

Appendix G: Email, Registrars' Decision

26 de septiembre de 2013

Sra. Ivette Delgado Rivera
Estudiante Graduada
Departamento de Inglés
UPR- Mayagüez

Estimada señora Delgado:

En respuesta a su solicitud para obtener los números de estudiantes para la muestra de su investigación, le informo que luego de haber discutido la misma con la Sra. Maira Rodríguez, Analista Programadora de Sistemas Electrónicos II, de la Oficina de Investigación *Institucional y Planificación,* acordamos que la Sra. Rodríguez le proveerá la información solicitada con un número aleatorio asignado a cada estudiante. El número aleatorio va a estar relacionado al número del estudiante y de esta manera usted podrá obtener la información que necesita para su investigación, sin necesidad de tener acceso a los números de estudiantes. De esta forma, estamos cumpliendo fielmente con los requerimientos del "Family Educational Rights and Privacy Act)".

Confío que con esta alternativa brindada usted pueda obtener los resultados necesarios para culminar con éxito su investigación. Cualquier duda o comentario al respecto, favor comunicarse con esta servidora.