

**Mathematics Far From Home: International Graduate Students Struggle to
Succeed in Canadian Universities**

**Mathematics Far From Home: International Graduate Students
Struggle to Succeed in Canadian Universities**

By

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ABSTRACT

Mathematics departments at Canadian universities accept yearly many international graduate students, who are aiming for the MSc and PhD degrees offered by those departments. This study seeks to understand the difficulties faced by some of those students at English-speaking Canadian universities. Its main aim is to determine why some international graduate students struggle with mathematics courses at a graduate level, even though their academic achievement in their home countries may have been high. In this study we want to know whether this problem is related to language barriers, to the time gap between the last acquired degree and the current one, to the educational systems to which students have been exposed in their countries of origin, or to other reasons. I interviewed twelve international graduate students from McMaster University and University of Guelph as well as three faculty members from the Department of Mathematics and Statistics at McMaster University. The students who participated come from different countries: Russia, Belarus, Slovakia, Pakistan, India, Bangladesh, Turkey, Iran, China, and Saudi Arabia. While some of those countries seem to have similar cultures and life styles, others are distinctly different. The interviews helped me to draw a deeper perspective about the problem by exploring the reasons that hamper some of those students from succeeding in their courses, and asking the participants to provide their suggestions to other students and faculty members on how to eliminate these obstacles. This study helps to improve the academic graduate programs of the department of mathematics by adjusting to students' needs and enhancing their learning outcomes. It also suggests to international graduate students to discover and examine their weaknesses and prepare themselves academically to fulfill the requirements of their programs.

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CHAPTER 1

INTRODUCTION

It is obvious that students who have been accepted as international graduate students in mathematics programs satisfy the admission requirements of these programs. These requirements include conditions regarding the Grade Point Average (GPA) of the bachelor's degree the students hold, as well as other conditions, such as language proficiency. In most Canadian universities, international graduate students applying for MSc programs must have an honours-level Bachelor's degree with a minimum average of B+ (FGPS, University of Ottawa) or minimum average of B (GSAH, York University; AGIA, University of Waterloo). Applicants must write a Graduate Record Exam (GRE) in some other universities such as Dalhousie University (GPS, Dalhousie University). In the Department of Mathematics at McMaster University, some conditions regarding the GPA need to be satisfied by students coming from specific countries. In more detailed words, the following conditions are indicated as admission requirements by SGS, McMaster University:

- From China: require a 4-year BSc degree, with an average over 4 years in the major subject of 85%.
- From India, UK and other British systems: require an Upper 2nd class degree.
- From Korea: require an MSc, with an 85 % cumulative average.
- From Romania: require a 7.5/10.0 average in the major subject over the 4 years in the BSc.

In fact, McMaster admission requirements for mathematics and statistics MSc programs have been changed to be more restrictive. While the minimum GPA for acceptance used to be B+, it has been upgraded to A (85%) in 2012. In conclusion, admitted international graduate students are at least very good according to their previous academic records. Also, sealed letters of recommendation, written by-usually- 3 of the applicant’s previous professors are required for admission. Moreover, there are other requirements regarding English language proficiency. International students who are not from listed English speaking countries, or who did not graduate from a university where English is the language of instruction, must successfully complete an English Language Proficiency Test. Every university specifies minimum scores for each test. For example, in the University of Waterloo, the minimum scores are indicated for several tests as follows: (GSAC, University of Waterloo)

Paper-Based TOEFL (PBT)	Internet-Based TOEFL (iBT)	IELTS (Academic)	MELAB	CAEL	PTE (Academic)	EFAS
580	90; writing 25; speaking 25	7.0	85; 80 per section	70; 60 per band; 70 writing; 70 speaking	63; writing 65; speaking 65	80% overall in level 400

Despite all these formal standards, some international graduate students of mathematics experience academic difficulties in their English-speaking Canadian universities. They find some of the courses challenging while some others require specific skills which they need to improve. This study seeks to understand these academic difficulties. It aims to explore their occurrence in mathematics courses at graduate levels. Logically, one can think that those problems may result from lack of English language proficiency- keeping in mind that the academic field requires a standard level of English proficiency. The longer the time gap between

gaining the last degree and resuming higher education without being engaged with mathematics in the meantime is another expected reason. Also, the educational systems to which the students have been exposed in their home countries may be different than the Canadian one. In this study we focus on international graduate students who attend universities in Ontario, as English is the language of instruction in this province. Other reasons not anticipated here will be identified and investigated throughout this study.

MOTIVATION

Students entering mathematics graduate school often experience an “abrupt change of status” during this transition (Bozeman & Hughes, 1999) (as cited in Marsh, 2011). This may be more complicated for international students as they experience other cultural and systematic changes. While their academic standard may be excellent, international students often have trouble with their courses. Setbacks, such as an inability to meet professor’s expectations, or to fulfill course requirements, may wane self-esteem or even stimulate the desire to drop out of the program. These issues impact departments as well: international students’ struggles with mathematics graduate courses may negatively affect program recruitment as admissions committees are less likely to admit applicants with similar backgrounds in the future (Marsh, 2011). No doubt that the intention is not to reduce the number of international students as the benefits of international education to the Canadian economy is substantial and cannot be neglected. (Roslyn Kunin & Associates, Inc, 2009). According to (Andrade, 2006), “International students in institutions of higher education in English-speaking countries make valuable educational and economic contributions. For these benefits to continue, universities must become more knowledgeable about the adjustment issues these students face and implement appropriate support services”.

In fact, “the number of international students in Ontario has doubled since 1999 at both the master’s and doctoral levels” (HEQCO)(as cited in Wiggers, Lennon, and Frank, 2011). In order to keep this growth in international enrolment, it is necessary to shed some light on the

international graduate students' experiences with their programs, so that universities' programs can be improved to fit the needs of a wider range of foreign students, besides working on improving university's standards. In this study, we particularly focus on international graduate students at mathematics departments of Ontario universities. We mainly try to discover the obstacles which stand in the graduate students' way by hearing their impressions and experiences. We suggest some solutions, collected from the students' own experiences, in order to help future students with their struggles in graduate school.

Canadian universities admit graduate students coming from many European, Asian, and African countries. According to the reports of AUCC (2011), Iran, Saudi Arabia, Hong Kong, Japan, Pakistan, Taiwan, Germany, Mexico, and Nigeria – which account for 16 percent of Canada's full-time international students -- sent between 1,000 and 2,200 students each to Canada at the first decade of this century. I am one out of thousands of Saudi students attending foreign universities yearly aiming either for secondary or post-secondary education. The minister of higher education in Saudi Arabia established King Abdullah Foreign Scholarship Program (KAFSP) seven years ago. The Program encourages qualifying Saudi youth to take an active role in development in all fields within government and private sectors. The main aim is to actively create a high quality Saudi human resource base, globally competitive in the work market and in academic research, in both public and private sectors. To achieve this aim, the program sponsors thousands of Saudi students who wish to study abroad every year (KAFSP, The Portal of Ministry of Higher Education). As most of those students intend- at the first opportunity- to attend English-speaking universities, Canada is one of the countries that accepts a huge number of students under this program. This research will stand as an orientation for students coming from

Saudi Arabia- and some other places- aiming for mathematical graduate programs in Ontario universities; so that they can avoid or overcome some obstacles that they may encounter. On the other hand, this study may help mathematics professors at Ontarian universities to better understand the academic situation of Saudi graduate students- as well as of other international graduate students- so that they can modify their teaching plans, to offer what these students need to succeed. This study question is of great personal interest: in my own case, I remember when I looked at the first assignment of my first graduate math course at McMaster; I could not solve any of the questions, although they were not that difficult. I figured out that the eight-year gap between earning my bachelor degree and starting my higher education was more than sufficient to make me forget most things I learned, especially since I was not involved with mathematics for all of that time. Also, I experienced a language barrier at the beginning, as I needed to learn lots of mathematical expressions that I have never used before because I studied in Arabic in my home country. Later on, I faced another problem which I considered to be much more significant than the language issue. I discovered a major difference between the undergraduate courses taken in Canada and the ones I took in my home country. I felt depressed looking at almost every assignment given to me in two graduate courses I was taking. This was because I had to go back and review most of the undergraduate courses given to the students at McMaster University in order to be able to understand the questions on the assignments and subsequently be able to solve them. Of course, this is not a problem for me alone; some other graduate students are suffering too, and maybe they have different reasons for their problems. This is what encouraged me to do my research in this particular problem.

CHAPTER 2

LITERATURE REVIEW

Some researchers have categorized the difficulties that international students usually face into three types: (Meloni, 1986; Reinick, 1986) (as cited in Xu, 1991)

1. Personal problems which are related to finances, food, and housing.
2. Academic problems, such as lacking English-language proficiency, completing various academic tasks, and getting to know the North American academic norms and expectations.
3. Social problems, which include making friends and being accepted by social groups.

Many comparative studies have been conducted to discuss social and personal problems experienced by international students and other studies have concentrated on cultural issues. For example "(Yieh, 1932) found that culture shock can lead to homesickness and loneliness, and can negatively affect health, bonding, structuring academic and non-academic social contacts, marriage issues, and academic problems (as cited in Hartshorne and Baucom, 2007).

Most studies that I found were conducted in general, with no particular area of study in mind. However, we can include some conclusions of these studies and later, we will try to address similar inferences to the special branch of science, namely mathematics. In one of these general research studies (Zhou, 2010) stated that "graduate education can be difficult for international students to adjust to because of the heavy workload, unfamiliar academic cultures, and challenging assistant work". Also, in a pilot study (Jiménez, and Lechnitz, 2009), it was noticed that "the different teaching-learning methods used in the US caused some difficulty for many international students and especially for those used to a lecture format; several were not

comfortable at first with in-class discussion". (Meleis, 1982) indicated that "Arab students in The United States are disabled by differences between the Arab and American educational systems. Arab students seem to be far less communicative and tend to dialogue less. This is not due to a paucity of ideas or inability to debate as much as it is due to an educational socialization that has taught them that respect for authority- the teacher-should be manifested in careful listening". "Research has consistently cited inadequate language proficiency as one of the most important factors affecting international students' academic performance" (Xu, 1991). In their review of literature, (Spaulding, and Flack, 1976) concluded that "difficulties in English language negatively affect student's academic performance, social interactions, and general adjustment" (as cited in Xu, 1991). (Xu, 1991) suggested that "standardized tests such as TOEFL may not measure the language dimensions that are significant for academic purposes". As well, the GPA is not necessarily the most appropriate indication of academic success, especially for graduate students, due to its limited variance. Then, there are variables other than language proficiency that affect international students' academic success. And finally, other valid variables and research methods should be explored to investigate factors affecting international students' academic success. If this is so, we need to discover the other variables and factors- besides those mentioned above- that may affect international graduate students' achievement in mathematics. In this study, we want to shed some light on the academic problems and specifically the obstacles that hamper international graduate students' success in the courses they are required to complete for a graduate degree in mathematics.

We can benefit from the research conducted to discover key features and factors which contribute to the graduate students' success in mathematics; we can study what impact the lack

of such factors has on international students' performance. (Carlson, 1999) explored that high levels of confidence, and the presence of a mentor during the periods the students develop their mathematical skills (often as early as high school) all played a role in students' success in their higher education as mathematicians. From her point of view, it is the problem-solving behaviour of the graduate students who were considered to be successful (as cited in Marsh, 2010). (Bozeman, and Hughes, 1999) stated that "for many students, the preliminary exposure to graduate-level courses, the networking with other mathematicians, the focus on issues of culture and gender, and the exposure to a broad array of mathematical fields and people—all in a nurturing environment—might make the difference between continuing or leaving after the first year of graduate school".

In a study concerned with the transition to graduate school in mathematics, (Marsh, 2011) cited that (Kajander, and Lovric, 2005) detail McMaster University's efforts to address the high school to university transition through surveys of students' mathematical backgrounds, course redesign, and provision of a departmental review manual to enable students' voluntary preparation for their mathematics courses. They noted that students' motivation, ability to delve more deeply in learning, and secondary school preparation in mathematics were all key to the transition process.

There is plenty of information on the internet, such as the graduate pages found in the website Ask.com

[http://gradschool.about.com/od/transitions/Making the Transition to Graduate School.htm](http://gradschool.about.com/od/transitions/Making_the_Transition_to_Graduate_School.htm)

or

<http://gradschool.about.com/cs/transitions/a/howgraddiff.htm>

International students can also benefit from such websites; they can learn more about how to adjust to the transition from the secondary to the post-secondary level in a different educational environment, as well as the nature of the graduate level and what skills they need to improve in order to meet the requirements and the expectations of this level.

CHAPTER 3

METHODOLOGY

I am an international graduate student who experienced academic difficulties, and I realized what the reasons behind my own struggles have been. Still, some other international graduate students may have different academic problems that have been caused by different circumstances. In my research, quantitative data is not as important as qualitative data; I used interviews mainly because I needed to probe deeply and retrieve as many details as possible. A grounded theory research method is the appropriate design for this study as it is a research method that generates theory from narrative data and is useful for understanding how people resolve problems that are of concern to them (Adolph, Hall, and Kruchten, 2010).

Twelve international graduate students from McMaster University and University of Guelph participated in interviews for this study. The participants were asked first to answer a questionnaire that requires demographic data such as gender, age, ethnicity, the date and type of the last degree earned, the type of the degree offered at the completion of the current programs, and the starting date of the program. Then, these international graduate students were involved in open-ended structured interviews to provide more details about the research questions. Compensation in the form of a small gift was offered to each participant for undergoing the interview.

Also, three faculty members from mathematics department were interviewed following a similar procedure. The intention was to get viewpoints from some professors as they are directly related to the process of education. The rationale here was to determine whether or not the graduate course instructors are aware of their students' academic obstacles, and what

solutions they can suggest as they may teach the same courses for several years. Since the professors have a direct communication with the students in the class, it is reasonable to assume that the professors can identify some weaknesses among students who come from specific countries. Moreover, the fact that the professors can rank their students based on the academic evaluation as well as on the marks they obtained was another rationale for this assumption. It was important as well to know what the professors expect from the students.

The open-ended structured interviews confirmed the results I anticipated, and also suggested other reasons for academic difficulties with mathematics courses at the graduate level, experienced by the participants. All interviews were conducted by me. Each interview took approximately one hour. A recorder was used to record the interviews. Each participant was informed that the interview will be recorded. A verbal consent was obtained and recorded at the beginning of each session. The interviews were conducted during the day at a time convenient to each participant. The interview questions - both for the student participants and the faculty members-were basically designed to cover the investigation in the following sequence:

(1) First, the struggles have to be identified.

Not all international graduate students have the same experiences, opinions and impressions about the courses. Also, the same course may have been taught using several approaches, depending on the instructor. So, it won't be surprising if the same student has two contradictory perspectives about the same course. Because of that, I asked the participants in the introductory part of the interview to determine the level of difficulty of each course they

had, to judge the content of each course by its intensity and the topics it covers, and to specify whether or not they needed help in order to succeed in the course. With regards to the interviewees from faculty members, we asked them if they could possibly discover what their international graduate students feel about the courses they teach, and whether they ever noticed any weakness in the performance of their foreign graduate students.

(2) Then, anticipated outcomes should be examined.

I assumed- based on my own experience- that some barriers may result from specific reasons such as the lack of language proficiency, not practicing mathematics for a long time, having limited basic mathematical background, or unfamiliarity with the new educational system. So, I formed some questions- for both types of participants, students and professors- related to those anticipated reasons accordingly. In fact, these barriers and their causes are very broad; international graduate students in any department might be going through very similar experiences. Even though this is true, including such questions in the interview will lead the participants to explain in detail how exactly those factors affected their performance, and so, we will get an accurate picture for those cases. On the other hand, if some students do not attribute their struggling to these conditions- even if these conditions apply to them- it would be interesting for us to know from such students how come they do not see links between their negative experiences and those conditions. To state those two points clearly, I give this scenario, a part of an imaginary interview.

Me: Did you struggle with any of your courses? Did you need help?

Participant: Yes, it was hard to succeed in some of them, especially the real analysis course.

Me: Why do you think this course was difficult for you? Is that related to your level of language proficiency?

Participant: I do not think so despite the fact that my English is poor!

Me: Can you explain that please?

Participant: To pass the course, I was supposed to give a presentation for 50 minutes. The presentation is worth 30 per cent of my assessment. Honestly, I couldn't speak fluently. I paused so many times because I didn't know how to express some points. I thought my presentation was boring. Finally, I was surprised that I got 28/30 per cent for my presentation. The professor told me that he was considering the fact that I am not a native speaker, and so, he was mainly evaluating my knowledge more than my ability to give a fluent speech. I was suffering with this course because I didn't have enough time to solve the assignments. The questions of the assignments were tough and I needed a lot of time to solve them. In addition to this course, I had two more graduate courses plus TA (Teaching Assistant) work and readings for my research. I was very busy. So finally I passed it, but I was exhausted.

Me: So you do not think the lack to the language proficiency may stand as a barrier for international graduate students from math department?

Participant: It might be for some of them, but it was not in my case. However, I think that I still need to improve my speaking skills as I am planning to work in the USA. I will not be a good professor if my English speaking skills are not adequate.

Me: Let's go back to your standard in English; I believe that you satisfied the admission requirements regarding the English language proficiency...

Participant: Of course I did, My ILETS score was 6.5; just as required.

Me: Ok, but this means that your standard is good and you are qualified to attend the university. How come you think you are not a good speaker?

Participant: I can speak English very well in terms of communication with other people, presenting about a general topic, especially that this kind of communication does not take long time and I can take turns with the others. My major requires me to learn mathematical vocabulary and to practice speaking like a mathematician. Words like "parallel", "injective", and "radius" are not commonly used in the daily life and not even used when you study English as a second language.

We can deduce from this piece of interview that the student had a hard time succeeding in the course, and that was not because of his poor English. We pointed to the language proficiency in the question as a possible barrier, but it was not really counted as such in this case specifically. If this professor ignored the student's limited speaking skill, appreciating his knowledge, other professors may have a different point of view; they might consider evaluating

the student's ability to present in good English as the student is supposed to be a professor in the near future.

We can notice as well how exactly the lack of English language proficiency may affect math students; mathematicians use their own vocabulary. Some mathematical expressions are not familiar even to native speakers.

Generally, those questions which discuss specifically the reasons we anticipated, resulted in a clear picture about the problem. They guided us to other factors and details, which we emphasise in our next step.

(3) Then, what other factors can be identified

We explained previously why the middle part of the interview includes questions about the anticipated reasons for the problems. We are aiming to point out some anticipated reasons for the problem and then we observe their thinking processes. They might follow the same paths we charted, confirming what we have expected. In contrast, they may show us other possible paths leading to the main research question as well. We will be interested to know what other reasons can be discovered. For this purpose, we formed some broad questions like: "why do you think you have these difficulties?" , "Is there something important we missed or is there

anything else you think I need to know to understand what it is like for an international student to study mathematics in a graduate program in Canada?”. We free the questions from any provision in order to retrieve more possible factors. Some questions included some broad outlines like: “Are there any financial, social, or cultural reasons?” as the problem is not necessarily related to academic reasons only. Simply, we are just like the one who draws a tree with several main branches and let other branches and twigs be drawn by the participants, so that finally the picture is complete. We asked similar questions of the faculty members, believing that they could reveal some other important reasons; that even the students themselves might not be able to figure out.

(4) Finally, solutions, suggestions, and ideas are welcome.

The last part of the interview questions were designed to collect the students’ successful strategies to overcome the barriers they encounter, and their suggestions with regards to improving the graduate programs. This helped us to identify some suggestions that help the current and future international graduate students to overcome their obstacles, and contribute to the improvement of the mathematics graduate programs as well. This part of the interview questions was applied also to the faculty members we interviewed because we intended to provide integrated suggestions.

DATA SOURCE

The first group of participants consists of twelve international graduate students. Nine of them are from McMaster University, while the rest are from University of Guelph. Some of them are from countries neighbouring each other (i.e. Pakistan, India, and Bangladesh), and some not. So, some participants represent different cultures and systems of educations and others seem to have similar experiences. Also, their impressions about the problem were diverse; some students do not have any problems with mathematics courses at the graduate level, while the others experienced different levels of struggling with the courses. In general, each one of my interviewees came from different circumstances; because of that, I got a variety of perceptions. Selecting those participants was not difficult, as most of them were from McMaster.

I would like now to introduce my graduate student interviewees, and I want to inform the readers that all names used in this study are fake. The name I picked for each participant is common name in his/her country.

I will start with Vladimir. He is a 26-year old male from Russia. His major speciality in his undergraduate degree was Physics. He has just finished a program that took him to three different universities in Italy, France, and Poland. Vladimir holds a master's degree and he aims to earn another master's degree from McMaster University. He started his program at McMaster in 2010. Until now, he has completed six mathematics courses at the graduate level in both pure and applied mathematics.

Our second participant is Shazia, a 40-year old Pakistani female. She earned a master's degree in pure mathematics in 2006. She earned her bachelor's degree from Pakistan, and her

speciality in undergraduate school was mathematics. In 2009, she started her course option mathematics graduate program. She has completed eight courses of both pure and applied mathematics, and by so doing she earned a master's degree in mathematics. Now she is preparing to conduct her PhD research.

The third participant is a Saudi female. Her name is Reema. She is 31 years old and has a bachelor's degree in mathematics and education. She graduated in 2002 and stayed away from the field of mathematics for eight years before starting her master's program. She conducted her graduation project last year. She has completed two courses in applied mathematics, two courses in pure mathematics and two courses in statistics. Her academic standing is very good.

Katrina, the 25-year old graduate student, coming from Slovakia, is my fourth interviewee. She earned her bachelor's degree in England in June 2011, and started immediately her MSc program at McMaster University in September 2011. Katrina has completed four courses among levels 6 and 7; three of them are pure mathematics courses and one is a directed reading course.

Moving to the fifth participant, I introduce Tanya, who came from Belarus. Tanya is 25 years old. She received a Bachelor's degree in 2009. After working as a database developer in her home country for one year, Tanya came to Canada in September 2011 to start her Master's program at McMaster. Tanya has finished two courses in applied mathematics and two courses in analysis.

The Saudi student Ahmed was the sixth in the list of interviews. He is 32 years old. He worked as a high school teacher for six years after his graduation in 2000. Then, he became a

demonstrator- which is similar to working as a teaching assistant- in the department of mathematics at Um Al-Qura University in 2007. After that, he got a scholarship to continue his higher education abroad, and he started a Master's program at University of Guelph in 2010. He has finished three level 6 math courses at University of Guelph, and one level-7 course in University of Waterloo.

The seventh interviewee is Mira, a 24-year old Indian female student. After her graduation in 2007 from India, Mira started- in her home country- a master's program and earned the degree in 2009. She got another master's from University of Guelph in 2011. She is working on her PhD thesis at the same university. Mira completed four level 6 applied mathematics courses in her MSc and four other courses for PhD.

Our eighth participant came from Bangladesh. His Name is Saleh and he is 39 years old. He earned his bachelor's degree in mathematics in 1995. By 1996, he finished his master's in Bangladesh. He worked there as a lecturer for twelve years. In 2008 he was accepted as an MSc student in Sweden, so he obtained another Master's degree in 2010. He moved to Canada to start a PhD program at University of Guelph in 2011. As for degree requirements, Saleh has finished four applied math courses.

The 28-year old participant Yuan is from China. He graduated with the bachelor's degree in China in 2007, and then received an MSc degree from a university in his home country in 2009. When he first came to McMaster in September 2009, he intended start the PhD program, but according to the graduate school requirements, he was supposed to finish an MSc degree first, and that took 2 years. In 2010 Yuan started to work on his PhD. He completed six level 7 courses for MSc degree and four more for PhD.

Next, I interviewed a Turkish female student. Her name is Tuba, and she is 24 years old. She became a bachelor's degree holder in Turkey in 2009. After she started a Master's program there, she got a scholarship from the Turkish government to study in Canada. So, she started to improve her English language skills preparing herself to study abroad. Tuba has completed four graduate pure mathematics courses.

Ali, the 27-year old student is the eleventh student on the list. He is a mathematics graduate from Iran, where he earned his bachelor's degree in 2006. In 2008, he received an MSc degree in computer engineering. He attended McMaster University in 2011 aiming for a PhD program, but he needed to earn an MSc degree first in order to move to the PhD level. He has completed 3 graduate math courses in model theory and analysis.

The last interviewee is Lan, a 35-year old female student coming from China with a degree in physics. She earned her bachelor's degree from a university China in 2000. Between 2005 and 2007, Lan completed a sufficient number of undergraduate mathematics courses at University of Waterloo to earn a bachelor's degree in mathematics. After that, she received a Master's degree from Wilfred Laurier University in Waterloo. In September 2011, she joined McMaster University aiming for another Master's degree. Lan has completed eight graduate courses as required.

I also interviewed three faculty members, which I introduce next.

Dr. S. Bernard came with her Ph.D. degree from New York University. She has been working as a professor for about twenty years, teaching for a while in the U.S. before coming to McMaster.

Then I interviewed Dr. W. Harbour, a mathematics professor with a degree from Stanford. She is teaching mathematics courses since 1948. She used to work at Stanford before moving to Canada.

And finally I had an interview with Dr. E. Nelson, who graduated from Princeton. He started his career as a math professor in 1980.

CHAPTER 4

DATA ANALYSIS

All international graduate students who participated in my research were interviewed using an eighteen-question protocol. I usually started with questions such as “how long have you been in Canada?” or “Are you enjoying it here?” as I intended to relax the participants and pave the way to the other questions, which I previously explained in my methodology.

I collected the data during the second semester of 2011-2012; the interviews were conducted at a time convenient for each participant. I spent about 60 hours transcribing the recorded interviews. I needed sometimes to interpret what the participants said and/or meant because they are not native speakers. I used open coding in my analysis procedure, and worked on the first twelve transcripts together, as they contained the interviews with the international graduate student participants.

(Strauss and Corbin, 1990) define open coding as “the process of breaking down, examining, comparing, conceptualizing, and categorizing data”. Using an open-ended structured interview played an important role in making the coding all transcripts easier; comparing the twelve international student participants' answers to the same question eased the process of labelling the concepts and categorizing them. I created a union of all properties to each category through all twelve transcripts. Then, I only needed to determine the dimensional range of each property for each participant of the students. Finally, I arranged my analyzed data in a list to simplify reading them.

The faculty members' interviews were analyzed separately following the same procedures; of course, those interviews represent perspectives from other angles to the topic of this research.

Mainly, I categorized the transcripts' conceptual labels into 8 axes: 1. Basic major; I identified two properties for this category: the level of relevance to the current program and the amount of work done towards the completion of the current program requirements, 2. English language proficiency; this included the four main language skills: reading, writing, speaking, and listening, 3. Educational system in the previous institution. This axis has two subcategories. The first one relates to features of a course (e.g., was it computer-based?), its content (i.e. to what level it covers the expected basics?), its approach (i.e. did the student take the course with an approach similar to the one offered at the current university?). The other subcategory is assessment methods, and I identified four properties for it; these include assignments, projects, midterm- in class exams, final -in class exams, or final-take home exams, 4. Educational system of current institution; this is similar to the last category as it has the same subcategories and corresponding properties, 5. Time gap between earning the last degree and the start of the current program; the properties in this category are the length of this period of time and the information on whether the student was or was not involved in mathematics during this period, 6. Other reasons; I found that these reasons fall under one umbrella, which is "overload"; that the participants were overloaded because of social requirements, financial requirements, academic requirements, or cultural requirement, 7. Learning more courses or reading more books; this was some participants' way of dealing with their problem. Also, it can be considered as the participants' advice to other international graduate students. Four properties were

identified to describe this category; the course that participants think they need to learn are either graduate math courses, undergraduate math courses, academic English language courses, or computer programming courses. Same classification will be followed if the suggestion was reading text books, and 8. Improving graduate math program; it is the category that represents participants' suggestions to the faculty in order to weaken their struggles. The properties of this category describe the faculty expectations with respect to students' academic performance, students' language proficiency, and students' technological skills.

The following schedule shows a sample of three participants' data analysis:

Conceptual label	Category	Properties	Dimensional Range for		
			Vladimir	Shazia	Reema
Last degree/ Last speciality/ undergraduate speciality	Basic major	Related to the current specialty.	Closely related.	Typically related.	Typically related.
		Sufficient to meet requirements of the current program	Insufficient	Sufficient	Insufficient
Language of study at previous institution	English language proficiency	Speaking	Sufficient	Sufficient	Insufficient
		Writing	Excellent	Excellent	Sufficient
		Reading	Excellent	Excellent	Sufficient
		Listening	Excellent	Excellent	Insufficient

Mathematics courses taken for the previous degree	Educational system of previous institution	Courses' Basis (computer programs)	Yes often	Not at all	Not at all
		Courses' Content (covering basics);	High	High	Low
		Courses' number	Limited	Appropriate	Appropriate
		Courses' options (selectable)	Yes often	Yes often	Not at all
Mathematics courses taken as part of current degree	Educational system of current institution	Courses' Base (computer programming)	Yes often	Yes often	Yes often
		Courses' Content	Intensive	Intensive	Advanced
		Courses' number;	Insufficient	Sufficient	Sufficient
		Courses' options (selectable)	Yes often	Yes often	Yes often
Methods of assessment at previous institution	Educational system of previous institution	Assignments	Not required	Not required	Not required
		Projects	Not required	Not required	Not required

		Midterm exam (in class)	Not required	Required	Required
		Final exam (in class)	Required	Required	Required
		Final exam (take home)	Not required	Not required	Not required
Methods of assessment at current institution	Educational system of current institution	Assignments	Always required in all courses		
		Projects	Required in some courses		
		Midterm exam/ quizzes (in class)	Required in some courses		
		Final exam (in class)	Required in some courses (level 6 courses only)		
		Final exam (take home)	Required in some courses (level 7 courses only)		
Date of graduation for last degree/ date of starting current program	Time gap between last degree and current one	Length	Very short (1month)	Long (3 years)	Very long (8 years)
		Staying Attached to the field	Yes	yes	No
overload	Other reasons	Preparing for academic requirement	Low	High	High
		Social requirements	Low	Normal	High

		Financial requirements	High	Normal	Low
Students' solution to solve the problem	The need for Learning more courses	Undergraduate math courses	Not needed	Not needed	Needed
		Graduate math courses	Needed	Not needed	Not needed
		Computer programming courses	Not needed	Needed	Needed
		Academic English courses	Not needed	Not needed	Needed
Students' suggestions for the faculty	Improving graduate math programs	Academic expectation	Should be lower	Normal	Should be lower
		Language proficiency expectation	Normal	Normal	Should be lower
		Computer technology expectation	Normal	Should be lower	Should be lower

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ANTICIPATED OUTCOMES

Results of other studies concerned with the academic problems of international graduate students can be summarized as follows: “students who are younger and who had a longer period of prior English training encountered less academic difficulties than those who are older and who had a more brief period of language training prior to their academic programs in the United States” (Xu, 1991). (Zhai, 2004) stated that “results of her study showed that adjusting to academic stress, cultural differences, and language challenge were the three most significant issues for international students”. In this study, I anticipated that the participants may mention some of the reasons that I previously identified as the findings of other related studies, such as the lack of language proficiency and differences between the educational systems of the country of the graduate students’ previous university education and the Canadian educational system. I hoped that participants might reveal some unanticipated reasons, or maybe other specific issues related to the main problem of this research. In fact, my expectations of the outcomes not only result from other studies, but from my personal experience as well.

CHAPTER 5

RESULTS

The open coding procedure helped me to present the results in a well-ordered way. In what follows, I illustrate participants' answers to all questions following the categories I set in my open coding.

IS THERE A PROBLEM?

Following the strategy I set in my methodology, the first part of my interview started with the question: What graduate level mathematics courses do you study, or have studied? And then I asked: What do you think is the level of difficulty for each of these courses? Are they too difficult, moderately difficult, just right, easy, or too easy?

I now quote what each participant said.

Vladimir: "I completed eight graduate courses; seven of them are level-7 and only one course from level-6. I had: (721) Analysis 1, (723) Functional Analysis, (727) Partial Differential Operators, (741) Applied Mathematics 1, (742) Applied Mathematics 2, (744) Asymptotic Analysis, (748) Topics in Mathematical Physics, and (6AT3) Topics in Analysis. All of my courses were good. They were not difficult for me some of them were stressful because they required lots of work".

Tanya: "I started with 2 level-7 courses; (721) analysis1 and (741) applied math 1. Now I am studying one level-7 course, which is (742) applied math 2, the other one is level-6 course. It is (6AT3) topics in analysis. I still need to do two more courses to fulfill the requirement of the program, and I will do them next year".

"Well I would say that level-7 courses are quite difficult because my background is different. Level-6 course is ok, but I think it is going to be tough later in the last lectures as the topics of the last chapter are advanced".

Katrina: "I had four courses between level- 6 and level- 7. They are (731) Algebraic topology 1, (6A03) Real analysis 2, (701) algebra 1, 4 courses, and (798) Directed reading".

"I think it depends on lecturer; subject as algebraic topology is very hard, and we were given only four examples. After 2 or 3 weeks of starting the course, the calibre of workload became incomparable to workload of algebra. So the level of difficulty depends on what lecturer expects from students. Algebraic topology was the hardest for me because I think there was a difference between what we read in the text book we use and what we received in the class. The book was quite hard and going into details and other things, whereas our lectures were quite easy made by the professor. He could just go over many things but not in appropriate depth. The lecture was similar to a seminar for fun but then it does not help you to solve the problems. If we want to solve the problems of the assignment; we have to know the details. we have to do the

calculations so than we tried to study the book, suddenly, it turned out; we found that we have to read 30- 40 pages to cover the first two lectures. In addition, it was very hard to understand the book; the author was not quite organised. Basically the professor's lectures were brief and the course was so intensive. Sometimes the professor was either forgot to tell us some information, or used different notation; so the lectures were messy in general. He was very nice as a person and tried to help us but sometimes his definition was very different from the book. The terminology and problems explained in the book were different from what the professor did in class. As a student I find it very confusing. The other courses were much better; algebra was quite challenging and hard but it was presented very well. So it was much easier to learn it and it was interesting as well. Real Analysis was the easiest course because the lecturer was much organised; he didn't only prepare the material neatly, but also tried to explain it with some connections in between the topics and give us some kind of overview. So I found that very useful. The problems of that course were easier as it was an undergraduate course. The last was a directed reading course that was comparable to algebra. It was quite hard to learn, although it deals with some undergraduate topics. We used to read a lot of material from text books written in an advanced way. Maybe this is what made the course challenging. But however it was nice and beneficial".

Shazia: "I studied 8 courses which were mixed of pure mathematics and applied mathematics, so I studied algebra 1, analysis 1, applied math 1, applied math 2, numerical analysis, one full-year course which was foundation of statistics, and finally I had financial markets course. All of them are level-7 courses".

“Courses like applied mathematics 1, foundation of statistics, and financial markets were difficult for me, not because of the material; they were problematic because they required working on mathematical programs like MATLAB, MAPLE and EXCEL”.

Mira; “Here I took dynamical systems, partial differential equations, transport phenomena, biophysics, biomathematics , numerical analysis, and now I am taking scientific computing and functional analysis. The first four courses were for my Masters and the last four are for my PhD”.

“For me the most difficult was transport phenomena; although I did it in 2009 but still I have struggled a lot with that. I got 95% in all other courses and in that one it was really bad. Functional analysis was also difficult. I like this course but I think the way the professor designed the midterm and the final exam was not that good because the exams were in-class. Most of the PHD courses we had require assignments, take- home exams, and projects. For a course like functional analysis, which is pure math, it’s hard to solve the questions in 1 hour. If it was differential equation course, it will be easy to solve because there is a standard pattern that can be followed. If you have something to prove, you have to think a lot and this is a difficult task to be done in one hour. If we have an assignment of 4 questions, we usually take 1 week before submission. We can think about every question every day, searching and reading this book or that book. But when you have an exam it’s hard to think about those questions in 1 hour. So at graduate level I prefer take home exam instead of in class”.

Saleh: "I have done two courses, Partial differential equations and dynamic of transport phenomenon. Now I am taking two courses, numerical methods of transport phenomenon, and biomathematics".

"None of them is difficult, they are all right. They are not too easy, as I need some time to understand and solve the problems of the assignments. I can say they are good".

Yuan: "I had (721) Real Analysis, (722) Complex Analysis, Those were required, and I also had (741) Applied Mathematics, (742) Applied Mathematics 2 I also took a course which was directed by my supervisor which is "Poisson- Dirichlet distribution" under (798) the Reading course, and finally (761) Geometric Topology. For PhD, I had Stochastic Process courses. I had a course from the Physics department which is Biophysics. I also had Financial Mathematics and Riemannian geometry".

"It depends; as before I came here I had already completed my Master's degree in China. So I already studied most of them in China. I think that most of the courses were not too difficult for me. I am a little bit comfortable with those courses. One course was an exception, which is the biophysics course. This course was provided by the physics department, in which the background is kind of different, so I had to get used to that. Also, it was difficult because I have never write a program before, even though I knew some of computer language but never actually write some computer program to do some simulations. In this course I was required to write simulations using computer program with each assignment and even for the final take home exam, I had to do a project. This was including reading papers, picking a topic, and then you write simulation

using computer programming to support your result. So I had to know how to write computer programs. That was kind of challenging for me”.

Lan: “Because I am interested in finance, I attended the M-Phimac program, which requires completing eight financial courses. The courses are: Mathematics of Finance, Applied Computational Finance 1, Applied Computational Finance 2, Topics in Financial Mathematics, The Mathematics of Credit Risk, Financial Markets, Statistics, and Portfolio Theory and Incomplete Markets. All of them are moderately difficult, they are not easy courses”.

Ali:” January 2012 is my first term, so I have complex analysis, model theory, and reading course, in the reading course I cover applications of model theory. I still have to complete three more courses”.

Reema: “ I had Applied Mathematics1, Applied Mathematics 2, Numerical Methods of Differential Equations, Foundation of Statistics- and this is a full-year course; which means that it weights as two courses-, and Algebraic Topology”.

“I started with the applied mathematics 1 course, which covers ordinary differential equations. Honestly speaking, I can see now how easy it was, but this was not my opinion by that time. I attended the university eight years after graduation. I almost forgot everything I studied in mathematics as an undergraduate student. Moreover, the undergraduate courses I had in my home country were not intensive. I figured out that I

still need to learn more basics. The problem with that applied math course was using MAPLE to solve the question of the assignments. I have never used a program before to do such thing. The language used in the lonely programming course I studied was old FORTRAN, which is not used nowadays anymore. The applied mathematics 2 course was difficult for me; it required much more basic than the limited I had. The numerical method of differential equations course was good. The only difficulty was using MATLAB. I arranged with a tutor to learn this program and that was all what I need to pass. I struggled with the statistics course also because my background is very limited; I only studied two introductory statistical courses in my undergrad. The course also required sometimes working on R program, which was completely new for me. The last course is algebraic topology and this was nice but challenging; I struggled sometimes because the professor used different notation, which made me confused. In fact, the professor's expectation was high compared to what I have of knowledge.

Ahmed: "I completed three level-6 courses in the last semester, and I still have to complete three more. The courses I am done with are: Numerical analysis, biomathematics, and advanced partial differential equations. As I started before in University of Waterloo, I had one course from level 7, which is numerical analysis, but the professor taught that course with different approach. I was supposed to use programming and that was much easier than the approach used in the other numerical analysis course I had in the University of Guelph. So, although the numerical analysis I had in University of Waterloo was from higher level, it was easier for me. This latter one

was based on the use of mathematical programming; MAPLE, the required program, is easy and interesting. Despite the fact that I have not worked on MAPLE before, I got used to it very quickly. When I started at University of Guelph, I studied Numerical Analysis course too, but it was a little bit harder as the approach was not as easy as the numerical approach. The biomathematics course was interesting, but challenging at the same time. The last course is advanced partial differential equations and this one was good. It was not based on programming; all work was written. The only problem with that course was timing. One hour for mid-term exam and two for the final were not enough. The questions were set to exactly fit the time. There was no time to think about the different boundary conditions.

Tuba: "On graduate level I started in September and until now I had 4 courses, they are algebra 1, algebra 2, analysis 1 and complex analysis. I am done with two of them and still studying two".

"Algebra 1 was not difficult as well as the current course, which is algebra 2. Generally, I am knowledgeable in algebra, but not in analysis; that's why Analysis 1 course was very difficult for me".

Most of the students participated in this study indicated that they had difficulties at least with some of their courses. Vladimir, Saleh, and Yuan found their graduate courses appropriate. Yuan needed to review some materials

Discussing the graduate courses the students study here in their Canadian universities, I asked the following question:

What do you think about the content of the courses? Is it intensive? Good?

The answers were:

Vladimir: "I noticed that sometimes some professors do not follow the same course outlines shown in course webpage. The description of the course might be very brief while the course is intensive".

Tanya:" For me it is a little bit intensive. Because of the lack of having enough practical problems done by professors in the class, and the fact that having no tutoring classes for graduate schools it is harder. I know in some countries in some universities like US they do have tutoring for graduate students at least for 1st year. So for me it's hard because you have only one example in class and then I have to do all assignments' questions".

Katrina: "It depends on the course so for analysis, it was very easy; I only study for them like study only one day before the test. Topics were easy. Algebraic topology was hard. It was not intensive, but problematic because the professor was just keep moving from one topic to another without going on the depth of each topic; he was just covering the surface of the topic. If the professor was required to say 20 or 30 minutes, he used to say it's long so let's just skip it! He would not require us to go into details in order to understand it so we were not forced to do it but we had to understand the details to do the problems of our homework".

Shazia: "I think the courses are good, but I feel like we are just running, running, and running. I think we need more than 3 hours a week for each course".

Mira: "I think the only course was the transport phenomena which I feel like intensive. It was really fast and I couldn't get time to catch up with everything. Rest of the courses were ok. For Indian students I think even dynamical system was a new course we didn't have it there, at first it was hard; I thought I would drop this course but the professor was very helpful, he helped me a lot and I gained 90% in that. He was such a great professor and he was always there for help; like he gave us difficult assignments but I was always sitting with him and working on my assignments".

Saleh: "It depends on the professor. In my home country, the syllabus is decided by the college but here the professor has the right to add or remove topics and design the course. For the courses I had, I think the content was medium, not that much intensive".

Yuan: "Some students think that the courses are good but they are too intensive, and some are going so fast. I think that there was one course which was so fast, it was the Geometry course. That one was going so fast but the instructor was so good. Even though he was really fast, he provided a good structure and it is your job to look for the details. I think that this is very beneficial for us. You know the structure, how the things are going and then, when he let the details you go and pick up the details, and that's good. But that teacher went really fast. He covered the whole book within one semester, and also we had lots of assignments, so I think that course was quiet intensive. Usually we had about 10 problems per assignment and each problem is not an easy one. We had

about 5 or 4 assignments and each assignment contains 10 problems. It was not easy to deal with it”.

Lan: “For some courses yes like fundamental of financial mathematics is not easy to understand. You can read each word but not easy to understand. The content was intensive but it doesn’t matter; we don’t care how hard it is we just try our best as long as we want to get good jobs. Maybe this intensity is the better for us”.

Ali: “No they are not intensive they are good”.

Reema: “Some courses are intensive and some are not, and maybe I found some intensive because I needed lots of time to remember what I forgot and to catch up with the professor”.

Ahmed and Tuba think that the intensity of the courses is good.

The majority of the students agreed that some graduate courses are intense. However, some students think that the intensity of the courses is adequate.

Replies to the participants’ undergraduate majors question

All of my interviewees specialized in mathematics in their undergraduate programs in their home countries except for Vladimir, Mira and Lan. Vladimir and Lan were both from physics department, while Mira got a Bachelor’s degree in sciences.

I asked her: What about your undergrad major?

She said: "In India there is nothing like major, so I had 9 courses of mathematics, 9 physics courses and 9 chemistry courses. We call it BSC honours".

Vladimir earned a master's degree after his graduation. The topic of his thesis was "Mathematical modeling in engineering."

He said: "my previous Master's program required studying in three European countries, so it was in between three universities, University of La Aquila in Italy, university of Nice in France, and Technical university of Lodz in Poland".

He added:" I learned limited math courses in my home country because my major is not exactly mathematics, so I needed to have more graduate mathematics courses at McMaster in order to enrich my knowledge. My research discusses an applied mathematics topic, and I had sufficient applied math courses through my last master's program. My academic standing in these courses was excellent, but as branches of knowledge are connected one another, I felt that I still need to learn more courses in other branches of math and this is what I did".

Since Lan had a bachelor's degree in physics, she already studied courses in applied mathematics; as this branch of mathematics is common between mathematicians and physicists. To obtain a degree in mathematics, Lan attended the University of Waterloo in 2005 and studied more mathematics courses. So by 2007 Lan held a bachelor degree in mathematics.

ENGLISH LANGUAGE PROFICIENCY OF THE PARTICIPANTS

The participants: Vladimir, Shazia, Katrina, Tanya, Mira, and Saleh were studying in English in their home countries. During the interview, I noticed that they were expressing their opinions more easily than the others except for Tanya; she tended to use short sentences and she was shy as well. So, five students out of six have never indicated the English language as one of the barriers for their education in Canada. Reema, Ahmed, Tuba, Ali, Yuan, and Lan were studying mathematics in their home countries in their own mother tongue. All of them except Yuan said that the lack of the English language proficiency was a considerable barrier to their academic achievement.

In reply to my question: "Why do you think these courses are difficult for you? Is that related to your level of language proficiency?" I got the following responses:

Reema: "Yes, I had studied academic English courses before attending McMaster, but these courses are not effective because they cover only general topics, just like the daily life issues and newspaper titles but not mathematical topics".

Tuba: "Yeah, yeah, yeah".

Then I had a short conversation with Tuba about her reaction:

Me: What kind of language courses did you do in Turkey?

Tuba: "It's not related to speaking".

Me: Did you do ESL?

Tuba: "Yes, but we just learned grammar in English like writing, reading, listening. We didn't speak".

Me: Did you study English here in Canada.

Tuba: "Yeah I did last year in Toronto in the school of graduate studies of the University of Toronto because I needed to do TOEFL so I studied ESL course until I finished level 6".

Me: Did you find it different than the one you did in Turkey?

Tuba: "Yes it's beneficial because I am listening English all the time and I have to speak English".

Me: Is it enough for mathematics?

Tuba: "No because they don't discuss maths, for example when I first attend a class here, I heard the word (plane) and I thought that it means (airplane). I didn't realize its meaning in the mathematical term".

Lan has a similar point of view. She said: "For me yes, I would say if my first language was English, it would be much easier because sometimes I don't understand and I have to figure out what is said in the lecture, I have to know the meaning so language is a barrier for me".

Ali- the Iranian student- also found the language a little bit problematic.

Answering the question above he said: "Yes sometimes, for example when I want to write my assignments like in theory I made mistakes sometimes for example I write

numbers in Persian sometimes when I have to ask questions I encounter some difficulties but professors are so helpful and patient they just spend a lot of time with the students if I can't speak about my question in English they just give me some time to think about it and write about it but pure mathematics is not about language ability may be applied mathematics yes and like statistics depend on language ability".

I asked him: "Before coming here did you prepare yourself for English exam like TOEFL or IETS?"

Ali: "Yes I did TOEFL in Iran. English ability is helpful because when you have to search for material, when you have conversation with the professors, with the other students. My main problem is about the topics when I want to speak with Iranian students ok I have many things to say but when I want to talk to the Canadian students I don't know what should I say I have some confusion about topics. It is not about English, it's about cultural background or something like that".

Although The Chinese student Yuan did not receive his undergraduate or post graduate education in China in English as a language of instruction, he did not indicate the language as an obstacle for him. He said that he learned English before coming to Canada and he earned a good score in the TOEFL exam. In fact he did say that he is not as fluent as native speakers and he still needs to learn more about academic writing as he is supposed to write his thesis, but the language was not a barrier for him.

In Belarus, Tanya received her undergraduate education in English, and in spite of it, she has some troubles with speaking.

When I asked her the same question as above about language she said: “No I don’t think it’s related to language directly, I went to a language school before coming here to improve my language skills. Then I prepared for IELTS. My listening, reading, and writing skills are good; I can understand the lectures but I have speaking problem, and I am kind of shy”.

Mira had a similar situation as Tanya, she can communicate with people very well, but still not that fluent to present a mathematical topic; that she has to think in Punjabi or Hindi, and then translate it into English. Mira believes that she needs to practice on her presentation skills.

EDUCATIONAL SYSTEMS AND METHOD OF ASSESSMENT

Discussing the educational system of the home country of each participant, I asked: “As an international student, how do you describe the educational system of your home country? And how do you find it compared to the Ontario one?” As the assessment is a part of the educational process, I asked my participants also to tell me about the methods of assessments used in their previous institutions, and what do they think is better for them compared to the methods used in their universities in Canada.

Vladimir explained that the Russian educational system does not separate undergraduate and the graduate studies. The degree that students get when they graduate is equivalent to a combined degree, bachelors with masters. He said that the system has been changed lately; that educators have finally separated each stage of education, but he said that he belongs to the old system as he was not from the generation that underwent this change. The courses students learn in Russian universities are intensive and cover the basics appropriately.

Students are free to select courses, some of which are based on computer technology, so Russian students are in general familiar with mathematical computer programs. Regarding the methods of assessments, assignments are only given to the students so that they can prepare themselves for the final exam, which means that assignments are not used for evaluation purposes. Russian students are only required to pass an in- class final exam of each course. Moreover, grades are not important to them as having high grades does not increase the students' opportunity to get a job or continue their education. Vladimir said: "I prefer the Canadian educational system, especially for undergraduate studies; from my perspective, the Ontario system helps to improve students' learning outcomes by engaging them in different activities and evaluating them using various methods of assessment". Final take home exams are better for Vladimir as they allow the student to search and learn more. His critique of the system of education in his home country can be summarized in two points; first, undergraduate studies should be identified as an independent stage of education, and this has been already done. Second, the assessment method used in Russian universities is not effective; most students study only the three to five days before the exam in order to pass it and later they forget what they learned.

Moving to Belarus, beside Russia, Tanya mentioned first that the bachelor's degree takes five years in her home country. There are no strict rules about attendance. The main problem is the lack of references. All that is available there is written in English and it is confusing for the students to read English books and then translate what they read to their mother tongue. There are strict rules about what topics should be included in the courses. The minister of education set all programs so that there is no informal material. The courses are intensive and cover the

basics well; the undergrads study all kinds of differential equations, all branches of math. The mathematical computer programs like MATHEMATICA and MATLAB are used in applied mathematics courses, so the students are familiar with such thing.

The criteria for taking exams differ. Usually, the student takes four courses per semester. The number of students attending each course is high, and the students are divided into smaller groups; each group attends its own tutorial class. By the end of the year, the students have to pass four final exams as well as get good marks in the tutorial classes. The final exams are oral, with one hour presentation. The student has to present in front of the professor, and not in front of the whole class. The professor might ask the candidate to answer extra questions. That's why everyone has to study the lecture notes very hard. Tanya thinks that this procedure might be stressful sometimes, but it is effective as it results in deeper learning. About methods of assessments Tanya said: " I like assignments as throughout the course I work on them and this helps me to do my best. They are less stressful as they are usually due in one week time. Although the questions of those assignments are hard, I am getting used to them. I am getting used to presentations as well; it is not something I can do very well because of my limited English speaking skills; as well, I am shy. I like take-home exams; they are just like assignments. I had a take-home exam last semester, I had to submit in 2 days, it was quite difficult but I did well. This term we will have take-home exam, midterms and presentations".

We continue with our European participants, and talk about Katrina's perspective. Katrina is Slovakian but was educated in England. According to Katrina, the English education is of high standards. The curriculum for the courses is well designed. The technology is involved in the learning process; computer programs such as MATLAB are taught and applied. The academic

year is divided into three terms. Each term is eight weeks long. The students attend the lectures in the first and second terms. The students have to manage covering the whole material of the courses in each term. There is a one-month break between these two terms, but the students plan/are expected to catch up with what they did in the last term. The third term is used for revision and exams. The students need to study what they learned in both terms as they will be examined in the material of all courses together. This is exhausting and puts more loads on students' shoulders, but it is good as it makes the students connect what they learned in various courses. There is one more very important distinction: the students can attend supervision sessions. A group of two or three students can meet with the professor to discuss the assignments and ask questions. The advantage of such sessions is that the students are given individual attention, on top of benefiting from two other colleagues' questions and comments. Those sessions usually take place after a set of lectures, so the students do not need to attend larger tutorial classes, in which there is one instructor for twenty or more students.

Katrina added: "The assessment is like the biggest point of the whole system of education because it's not only objective; it depends on the lecturers and how they are going to assess the students. It's incomparable for two different areas; suppose you have two level-7 courses and both of them require doing homework assignments. You may be asked to do more in one than the other, and so your assessment in those two courses will vary. It depends on the lecturers and also the grading system they somehow evaluate the student. The grades I got last semester were quite surprising for me; that I expected to get worst in a subject but it turned out. I got A+ in the algebraic topology although I don't think my knowledge correspond to A+, while I didn't get A+ in the

reading course which I think I should've gotten that in it. I think if we were not assessed well, we would not learn better. In some courses we had very good assessment; in the algebra class we were required to solve 6 long assignments all along the term, so we were engaged to the whole syllabus of the course all the time and we were graded equally for each part of the course. In the algebraic topology course, the professor was not covering the whole material in the class, and we were assigned to solve questions that required more details. With regards to the exams, I prefer the take home because it's less stressful. In class you have to do it on spot and there are more issues not just mathematical reasoning and you are under stress that you will forget something. At home you have more time. So I think they are more objective. What I don't like here is that the candidates' names are displayed on the exam papers. I think that this is not professional; as if the professor doesn't like you, s/he can give you bad grades. At my previous university, we used to have long in-class exams; each may take three hours, and we would not write our names so than the person who does marking has no idea whose answer sheet it is".

Moving from Europe to Asia, we analyze replies of three participants: Shazia, Mira, and Saleh, talking about the educational systems of the three adjacent countries, Pakistan, India, and Bangladesh. Assuming that they have similar cultures, it was interesting to compare their education systems.

The Pakistani educational system is strong, as Shazia said. Courses are intensive and they cover all the basics students need to know to continue their higher education. It gives the same emphasis to all areas of mathematics. The failure to use technology in education at Pakistani

universities was the only comment Shazia had in criticizing the educational system of her home country. She said that she had no idea at all about how to use mathematical computer programs to solve her assignment questions, and she had to spend a lot of time to learn how to use programs such as MAPLE, MATHEMATICA, and MATLAB. In Pakistan, she never had a take-home exam. The assessment was based on mid-term and final exams only. She said: “assignments and take-home exams are very good as they urge the students to search and read more”. However, Shazia appreciates the educational system of her home country and also likes the system of education in Canada where she studied.

Mira indicated previously that the university system where she received her undergraduate education was different. She attended a BSC honours undergraduate program- as it is called in India. The program takes three years. She was supposed to complete nine mathematics courses, nine physics courses, and nine courses in chemistry in order to graduate. Then, she received a Master’s degree with course-work only, by completing fourteen mathematics courses. The three years of BSC together with the one-year MSC were counted as Canadian Bachelor’s degree when she applied for University of Guelph. About the content of the courses she completed in India, Mira said that they were covering the basics and they were very intensive. The difference was the approach of studying. For example, she said that she was not so familiar with sketching graphs because in her previous institute, the professors did not give this part of math serious attention.

Mira also explained about the criteria of examinations in her undergraduate institution. She said that the exact same questions which were discussed in the lectures appeared on the final exam. Honestly speaking it sounds like it was easy to do the same questions in the exam,

but it wasn't because the course material was vast, and intensive. The students usually fill up 3 or 4 big notebooks with lecture notes, and they have to study all of it in one or two days before the exam. "It was hard and not easy" she said. She thinks that both systems- the Canadian and the Indian where she studied- have advantages and disadvantages.

She added: "The good thing to mention about Indian education system is that the student's memory becomes stronger the level of stress is getting higher. The student learns how to cope with that, as for here the stress level is not that high for Canadian students, for us as international students; it's high because we came from different backgrounds. If we were Canadians, courses will be considered much easier".

Mira spoke about presentations as a method of assessment that has never been used in her home country; she said: "My first presentation ever was in 2010 in my masters. Although I was an active person in India, I used to participate a lot in poem recitation, debates and things like that but we never had any presentation".

In Bangladesh, the situation was similar to that of India. Saleh said that he studied the same syllabus as here in the University of Guelph. What he thinks is different is the approach. Assignments were not used to evaluate learning outcomes. The students were only supposed to pass mid-terms and finals and he thinks that was not enough to provide deep learning. The students may finish their exams and then forget what they have learned. This is not the purpose of education. Also, because of this style of assessment, in which there are no assignments, the students tended to skip classes. Saleh stated that the education in his home country has improved in the last few years. More advanced educational methods have been embraced and applied. The use of technology is involved now, the methods of assessment have become more

varied, and overall the standard of the Bangladeshi universities is getting higher and higher.

Saleh graduated 17 years ago; so many changes occurred in the educational system in this long period.

He said:” as a lecturer, I prefer in-class exams for undergraduate students because the main aim is to evaluate the students’ perceptions to knowledge of the material, but for graduates, take-home exam is better to encourage them read more and do more search”.

Going to the north of India, we had two Chinese participants: Yuan and Lan. According to them, after finishing high school, young students have to pass a specific exam in order to be accepted in the universities. The exam tests the candidates’ comprehension of all what they have learned in their previous education; only the elite can attend the secondary stage of education. The undergraduate students have to complete a certain number of compulsory courses, and after that the students have the option to add what courses they want even if those courses are not related to their majors. In fact, one of the goals of a university education is to link knowledge from different subjects together. The student from science is usually encouraged to take courses from other different departments such as art or music. Yuan said that the Chinese educational system had embraced this concept from the West.

Yuan criticises the educational system of his country; he said: “All of my friends say that all the stuff they learned in the undergrad is just garbage and is never helpful in the real

world when they work. They didn't apply what they learned to the real life problems. This is unfortunately true; in college we are taught how to learn fresh stuff but we do not have the opportunity to apply it, and this what I think is important to do in college education. In China, they only teach us theories and all these abstract things but they do not teach us how to look for new stuff. So students may forget most of what they learned. So totally I do not think that what the college gives is enough for the future career".

Lan thinks that the Chinese system is good and it was easier for her to study in China. With regards to the assessment, students were supposed to solve assignments and write mid-term and final exams there.

Yuan said:" I do think that a take- home exam is a good idea. If you write a mid-term or final exam in class, the time will be limited and the professor cannot design difficult problems. In-class exams just test how familiar you are with this material but that is not the graduate student's need. For graduate students you as a professor have to create some new things, you have to come up with indirect ideas. A take- home exam is good for this purpose as the students will then have enough time to think about the problem; they can go over the reference books, they can also go online and check some materials, and then they can figure out the solution. The whole process imitates the process of research".

Lan states her point of view about assessment as follows:

“I think methods of assessment used in this program are really good. Assignments are beneficial. The mid-term and the final exams are in class and I don’t like that; it is too much stress. I think a take- home exam is harder, but it’s better and more convenient. For this term we will write a final take-home. I think presentation is good for the graduate students despite the fact that it is a lot of stress for me. English is not my first language; and I have to prepare to speak in front of people. I still need time to get use to speak English fluently and so get better results. Presentations are good in a way- I could learn more; that’s why I like them. Projects require deeper and harder work; and that means I had to put a lot of time. They are beneficial, but so stressful”.

Heading to the east, Ali said that the Iranian academic year is similar to the Canadian one; there are two semesters and each one takes about 13 weeks. The only difference between the two systems is that the students in Iran do not have the right to switch or drop courses. The study plan is set for all students and they have to follow it. He added that the courses in Iran are so intensive and they cover all the basics the students need and even more. Moreover, what high school students study in mathematics is deeper than what is usually taught in other countries. The topics they cover are advanced enough so that good mathematicians emerge. For example, Differential geometry is taught in high school while in some countries it is not even taught to fourth year undergraduate students. In Iran, the students are assessed using mid-term and final in- class exams. Other methods like presentations and assignments are used according to each professor’s wishes. Ali said:” in the course of complex analysis we have to give

presentations and no final take-home. The presentation is kind of so comprehensive; I have to speak for 50 minutes. The advantage of these kinds of assessment methods is that they encourage me to study and prepare very hard. I have to know the material well. But on the other hand, the audience might receive inaccurate information in case the presenter didn't understand some points. I think the professor should talk to the students before he/she gives the presentation to avoid any kind of deception or confusion. A take-home exam is good for me as a graduate student. I can have enough time for reading and organizing my answers".

As we are still in Asia, Reema and Ahmed explained that academic institutions in their home country do not necessarily follow a uniform educational system; that some universities may have distinctly different systems of education than others.

Talking about the educational system of her college, Reema said: "I am not familiar with the hours' system. I was following annual system, in which each semester is previously planned by the faculty".

She said also that the courses taught there did not sufficiently cover the basics that enable students to continue their higher education. The professor has the full authority to teach what she wants. Professors might sometimes avoid teaching particular topics because previous generations of students struggled with these topics. Also, in this college, students must study seven compulsory courses per semester; four of them are educational, and the rest of them are scientific courses. In particular, students from the mathematics department must complete three mathematics courses per semester in addition to four educational courses. Combining education with mathematics influences the intensity of the math course as the students are already overloaded by the number of courses they have to complete. Furthermore, students are

not allowed to reduce the number of courses they study per semester or even select the collection they want. Students do not select their courses. They are obliged to complete what they have in their plan; there are no more courses to be added optionally in order to help the students prepare for graduate school. Only one computer programming course was taught. In this course, students study the old version of FORTRAN, which is no longer used in mathematics. Students were not asked to apply what they learned in this course to solve any mathematical problem. This was the situation until recently. Since 2008, the system has been improved. The curriculum of the programming course has been changed to deal with new programs such as MATHEMATICA, and MATLAB. The courses are no longer mandatory, and students can select them freely. The educational courses have been now been separated out- they are to be taught in a particular distinct program- after the bachelor's degree. "Unfortunately, these changes occurred six years after my graduation" Reema said. She stated that the old system of education in her previous college was good because she thinks that selecting courses is not easy. When she attended McMaster, she didn't really know which courses she should take in the same semester.

About assessments, Reema said:" Assessment in this college is based on a midterm in-class exam and another final one to be in class too. Students are not familiar with solving assignments or preparing projects. Take- home exam strategies were not used. Students are never required to present as well".

Ahmed had a different experience although he had some problems in common with Reema. He said that besides having some mandatory courses, he was able to add or drop others. The courses he studied were good but the professors used to follow the old approaches.

Most of his professors came from India and Pakistan, and many students were struggling to understand their accents. The professors do not have enough office hours to communicate with students. The students had English text books, though most of them were not skilled in reading. Ahmed confirmed Reema's statement that the involvement of technology was limited. They used to study some computer programs such as MATLAB, but they never applied those programs to solving their mathematical problems. According to Ahmed, the syllabus was never updated or improved; what has been taught for the last 30 years is still taught until today. Reema confirmed this as well. Ahmed and Reema both said that they never took enough statistical courses. They had only two courses for their four years of undergraduate education. They said that the links between the courses were not defined. They graduated from the mathematics department without even knowing what courses support the others. They did not prepare any project for their graduation as this was not required. Ahmed said the same thing as Reema when we talked about the assessment in his previous university. He added: "assignments may be given for practice purposes but not for grading". For now, all of his courses are level-6. He had in-class exams for all of them. He said that the in-class exams he had were good and reasonable. He had a bad experience with one of them. He said that he arrived late while the exam was running, so he did not get the whole two hours. In addition, he was sitting on a chair designed for left-handed persons; he could not find another suitable one and did not like to waste more time seeking. The questions were not difficult but they exactly fit the time allowed to answer them. Because of losing a few minutes at the beginning of the exam, he received a lower mark.

He said:” I never had a take-home exam before. I think it would be better to have such a kind of exam as I will have enough time to do it, and I do not think that will be difficult as the take-home exam is similar to assignments”.

Tuba offered information about the Turkish educational system. She said that undergraduate students don't have enough resources; they complain about the lack of reference materials. For example, there are insufficient numbers of Turkish books concerned with algebra, despite the fact that algebra is one of the most important mathematical subjects. The students used to get help from the internet and buy English books. English is not the language of instruction in most of the universities. The end result is that the students struggle with reading those English books. Tuba thinks that education in Turkey needs more improvement. The students should be encouraged to acquire some skills like searching and reading. Libraries and study rooms should be affordable. However, this is not the situation in all universities; the universities in important cities like Istanbul have much more advanced educational systems. Tuba explained about the assessment method saying:” I was required to do assignments plus a take- home exam in both algebra courses, but for analysis and complex analysis I had assignments and presentation. A take- home exam is better than an in-class exam because it's more flexible; I can do it whenever I want at my home. I don't like to study in the class or in the library; I do not feel comfortable. I think graduate students have to do research and they have to learn more. For that reason, it's better to have take- home exams. In Turkey, we used to be evaluated only by mid-term and final exams that run in class”.

Almost all students indicated that the educational systems in the countries where they received their previous degree are different than the educational systems of their Canadian universities. For the majority of them, the Canadian educational system feels more comfortable. Most students had computer programming experience as undergraduate students, however they were not required to apply the knowledge and skills they learned for solving mathematical problems.

The majority of students stated that methods of assessments in their undergraduate institutions were limited. In-class exams, either mid-terms or finals were the dominant methods. Homework assignments are not given nor used in any way for assessment purposes. Presentations and projects were new types of assessment for some students.

TIME GAP BETWEEN EARNING THE LAST DEGREE AND STARTING THE CURRENT PROGRAM

Reema is the only participant who was away from practicing math for a longer time; most participants either started their higher education immediately after their graduation, or after a period of working in the field of mathematics.

WAS YOUR BASIC KNOWLEDGE SUFFICIENT?

I asked the questions: "Do you consider yourself well prepared for graduate school here?" And for Masters' holders I asked: suppose that you do not have a Master's degree from

your country, do you consider yourself well prepared for graduate school here?” and the question “Do you think you need more undergraduate courses?”

The answers came as follows:

Vladimir” without the Masters I got, no I do not think that; I would not be well prepared because I am from a physics department and my background of knowledge is different. I studied some courses for my last degree and that helped me a little. I do not think I need more undergraduate courses, but I needed more graduate courses and I really had them”.

Tanya: “I would say even Canadian students are not well prepared for graduate courses and as far as I am concerned, maybe I am not very well prepared because we don’t have advanced materials there in my country. We have another understanding of what we want to study, but here you can buy books, or you can go to the library. In our country professors give you all the material, and the complete lecture- it’s just how you deal with it”. Answering the second question she said: “Well maybe sometimes professors refer to some undergrad course that we don’t know about, but even in undergrad books you don’t find details and it’s not very good, it’s hard to understand”.

Katrina: “Definitely yes I am well prepared; we did many things in our courses like we repeated once again what we learned before in undergraduate courses, But honestly for some courses like complex analysis I needed to study undergraduate courses as I felt like I was missing something, so I am still well prepared and the need to review notes from the undergrad does not mean I am not ready”.

Shazia: "I think yes I am well prepared for graduate school because I studied very solid material as an undergraduate, the only matter is that I was not well prepared in terms of using technology. I do not think that I need mathematics undergraduate courses. I only needed programming classes".

Mira: "Yes I am well prepared, but not in terms of approach, I think I need more computational skills. In our country we never discuss math with anybody, it was just in books but here students discuss things with the professor or with their classmates. I think for maths, it is like the more you discuss the more you discover" she answered the second question: "I am pretty confident that I had taken a variety of courses as compared to the students here, so no I do not need to study more undergraduate courses".

Saleh: "I do not think so because what I studied in my home country was some theories and concepts in an abstract way. I didn't use any kind of computer programs. I learned about programs when I was in Sweden. In my home country, they are trying to improve the education now, so they offered those computational subjects that allow the students to use math programs". He added: "For now I do not need any undergrad course".

Yuan: "No I do not think so. I will be really struggling with the courses and the language.

Lan: "For graduate school I think so but I still have to learn more language. At this point I think I still need to learn more stats course to improve myself.

Ali: "Yes, I am good enough. What I received as an undergraduate was much more than what the students learn here, when I did my undergraduate work, I didn't plan to continue my higher education; so I didn't study my courses deeply. I just want to pass because my plan was to be a high school teacher. For example, sometimes undergraduate students come to me and ask some questions which are kind of trivial and in Iran if a fourth year undergraduate student asks these kinds of questions, it's kind of crime you know! In high school we study much more material in mathematics than here. For example, tangent of curve; they don't know it here. We studied differential geometry in high school in Iran. In pure mathematics, Iranian undergraduate students are excellent".

Reema: "I am not well prepared. I needed to learn and read so many topics to catch up with the courses. My knowledge was limited. Definitely I needed undergraduate courses. In fact, it was better for me to attend some fourth year undergraduate courses to prepare myself; unfortunately, I realized that later".

Ahmed: "Maybe I am not pretty much prepared; yes I needed to review some stuff because of the different approaches used here. Seriously, I needed to learn more undergraduate biomathematics courses besides some programming classes. However, I am doing much better now and I do not think I need more mathematics undergraduate courses".

Tuba: "No, because of the lack of English. Also, I forget some information. Here, I was required to have courses I do not like such as analysis, so I needed to review some

undergraduate stuff because I am not good at analysis. In fact, that's why I need to study undergrad courses now".

8 interviewees out of 12 earned Master's degree before starting their graduate programs in Canada. The majority of those stated that they are not well prepared for the graduate school. Also, three of the four interviewees who started their first Master's program in Canada expressed the same view.

TEACHING ASSISTANT WORK AND DIFFERENT IMPRESSIONS OF IT

Some participants indicated the effect of working as teaching assistants on their academic standing.

Vladimir mentioned that he was overloaded with the TA (teaching assistant) work in addition to the courses he had and his research. He said that he can't quit working as a TA or even reduce the working hours because of the income it provides; he needs to earn as much money as he can to pay for his fees and living.

Tanya confirmed Vladimir's opinion; she said: "I am going to speak to someone about the TA rate because they expect me to rent the cheapest room and buy as little food as I can; they pay exactly the budget for the minimal things I can get. I know it's my fault bringing my family here, but should I live separately from my husband? I have to pay for renting a flat myself and I am careless about if this income is only enough for room and food. It's not really something you want to have when you come here to study, you should just think about study

not anything else, but I know many students who are always thinking about how to earn more money in order to pay their tuition”.

Katrina had a different impression about that: she said: “I like it because first I need to learn how to explain things in different ways. It is somehow a sort of reviewing my knowledge because sometimes the students ask me something that I have to go back to my first year notes in order to answer. So I have to be well prepared”.

Shazia also found the TA work useful even though it takes time from her schedule. She said it prepared the graduate students for a future career and allowed them to improve their skills as lecturers.

Mira mentioned that the TA work exhausted her; she couldn't find time to focus on her research and courses. She said that was killing her, but she still has a point of view with regards to that.

She said: “But I like the system of TA; it improves teaching skills and introduces us to different approaches; for example, I learned something about the integration by parts; we did it differently in India. We did it as 1st function and 2nd function, but here when I taught the undergraduate students, it's different. They name one function as u and the other as dv ; so it becomes easier for them to apply the rule. They do it a lot more easily than what we used to do. So, actually when we teach them, we learn.”

Saleh said that working as a TA was fun for him and beneficial at the same time. Although he lectured in his home country for twelve years, he learned more ways and approaches here from his experience as a TA. He confirmed that the graduate students need to learn how to teach mathematics and how to make the concepts easier for the students.

Yuan said: "Personally, I think that this is quite good for me because in my future career, I will be working in the academic field and it is important to gain some experience communicating with the students and presenting some lectures. It was not stressful or exhausting; I was and still am enjoying doing that and I had enough time to do my assignments. The only problem is that the tuition fee is increasing every year, and with the TA work I only get the same amount of money".

Ali said: "TA is vital for more mathematics students because of experience. We should be able to talk about mathematics, but if the mathematician wants to go to a research field; doesn't want to become a professor, I don't know if it's beneficial for him/her or not".

8 of my participants were assigned to work as TAs; most liked it; they said that it is a good practice to refresh their memory; that they always need to review materials from their undergraduate studies. It enriches their experience, and improves their teaching skills. Few of those students indicated that marking is stressful as it takes a lot of time. Some suggested increasing the income they receive for this duty as tuition fees and other living expenses are rising.

The participants Lan, Reema, Ahmed, and Tuba are not assigned to do any TA work. Lan paid her tuition by herself and the rest are sponsored by their own governments. So, they did not talk about working as teaching assistants. I asked them whether they prefer to work or not. Ahmed mentioned that he would prefer if he can do few hours of work weekly as a volunteer to improve his experience in teaching, especially since he will be a faculty member in the future. Reema said that she cannot add such a task to her busy schedule. However, she does not expect to work in the university when she goes back home.

Tuba said that: “No, maybe some graduate students should do it if they are planning to stay here in future; so that they can benefit how to teach students”.

TELL ME FREELY, WHY DID YOU STRUGGLE?

I moved then to the next step in my interview plan. I intended to ask the participants about the reasons they think were behind their struggles. The question was: what do you think are the reasons for your struggles?

I also added: “Are there any financial, social, or cultural issues?”

Vladimir: “I did not find the courses difficult, they were ok with me. The difficulties for me were 1. To adjust to a new educational system, a new system of studying and assessment, and here I have to do so many things like being a teaching assistant, I am not only studying my own courses, so it is quite stressful, and also 2. I am from a physics

department so I have difficulties because of my different background. I needed to add more courses than the number required to cover what I needed to know”.

Tanya: “I had problems with some of my courses because the lectures were kind of brief, so I asked someone to explain to me as I also tried to look for extra material and reading more lecture notes”. Tanya has some financial problems; what she got from working as a TA in addition to her husband’s income is barely sufficient for their basic living needs. She needs to work more to gain more money, but cannot find time to do so as she is supposed to work hard on her studies.

Katrina said that her struggles did not result from language barriers, or lack of knowledge. She thinks she struggled in one of her courses because the professor was not covering everything in the lectures, besides using different notations and expressions in the class. She was confused and the course was not really organized. Unfortunately, she had that course in her first semester when she was trying to adjust to a new environment. Katrina said that she is enjoying it in Canada, but she feels uncomfortable as she has to come to the university from Waterloo. She settled there to be with her spouse, but it would be more convenient if she lives in Hamilton.

Shazia: “It was hard for me to study some courses because I am not a computer person, so the first difficulty I met was how to explore the things on the computer. My first semester was really tiring for me, but the second was good. So, with the passage of time, I know more now about computer commands. I was just not familiar with MATLAB, and MAPLE; so these two programs were my major problems when I studied the numerical courses”.

“I am a mother, and cannot ignore my children’s future. Yes they are old enough to take care of themselves, but still I wish them all the best and try what they need to succeed. We moved to Canada recently, and I keep thinking about my family and me, and how to adjust to this different culture.

Mira: “My struggles in total result from studying the courses with different approaches. Most of the professors in my home country are old-fashioned. For example, it was not easy for me to sketch graphs for some functions because when I studied mathematics as an undergraduate student, the professors who taught me never emphasised this skill. Also, I faced difficulties with in-class exams; I think they are not suitable for graduate students. It was difficult to have questions from higher levels to be solved in one-hour in the class”.

In addition she said: “When you are doing courses, research and TA, it’s almost killing you and when you have like weekly appointments with your supervisor you have to prepare yourself for those meetings; that it’s not like you are sitting there and he is talking, you have to participate in that so you have to be ready. In summer you don’t have any TA; you have GRA so you are just doing your research, and hence you are doing it more efficiently. With regards to my social life; I am single living with my dad. It’s just the loneliness that kills me”.

Saleh: “working as an assistant professor in the department of mathematics for twelve years enriches my experience dealing with different courses, and solving many problems. Seriously, I had no struggles with my courses; everything was good. I was similar to someone who studies the same courses every year for 12 years! I just needed

some time to adjust to a new culture. This time was not long, as I had lived in Europe before, and the culture is quite similar”.

Yuan did not complain of his courses; he was able to understand and solve his assignments. His main problem was using some computer programs to prepare projects, and solve assignments in his biophysics course. He said that he was free to choose whatever program he wants. He chose to do his work with C++ as he knows a bit about it, but his experience was not sufficient. So he needed to learn how to write codes. Moreover, he needed to know how to use that program with a different operating system; the computer in his office uses the UNIX system. Socially, Yuan missed his wife. He has been living alone in Canada since 2009. His wife has applied to come to Canada as an accompanying dependant but her application was refused. He also complained about cultural issues; he said that it was difficult for him in the beginning to get used to Canadian food. He used to cook his food by himself. Little by little, he adapted to a flexible diet. Yuan also faced some difficulties understanding different English accents. He used to live with a group of people in the same house, and it was embarrassing to ask his mates repeatedly for clarification.

Yuan indicated a financial problem; he said: “The only problem with TA work is that the tuition fee is increasing every year, but TA work money does not increase”.

Lan's main problem is her accent. She wishes to speak English fluently and clearly. She understands the lectures and she can read and write very well, but faces difficulties speaking with others. She is also married and because of her financial status, she left her daughter back home in China.

She said: "I should find someone who can take care of her while I am out in the university, or to register for her in day care, but this cost me much more money, and I cannot afford that. So I left her with my mother in China. I missed her so much; sometimes thinking of her distracts me from doing my work".

Ali: "some courses were tiring for me because they required prerequisites that I didn't have before. So that I needed to spend a long time reading to cover what I missed. Reading in English is challenging for me; not because my language is bad, but still I need more than what the native speaker usually needs for reading. Also, I sometime fail to express my point; again not because of lack of English, but because of the cultural differences". He added: "I do not have any financial problems since I have a scholarship. I just need time to make friends. I had my Iranian friends, but they are different than the friends I had in Iran; they can't feel intimate. The second problem is that we cannot find an appropriate community to fit into. Honestly, I have some kind of concerns about my future because i don't have any position".

Reema: “Mainly, the factors you discussed with me were applied to my situation: The lack of English language proficiency- especially in the mathematical field- the differences between the educational system of my previous college and my current university including the new methods of assessment I did not try before and the involvement of technology in studying math, the limited mathematical knowledge I have, and the long time I spent away from mathematics practices. All those caused me big struggles. Moreover, I was not appropriately oriented to the graduate school. I learned mathematics in my undergraduate years without even knowing how different branches of math support one another. Socially, I am a mother of little children, who need intensive care; I do not have time to help myself by reading and searching. Financially, I do not complain as I am sponsored by my government”.

Ahmed said almost the same thing as Reema; that he faced some language obstacles learning mathematics specifically.

He said: “I needed to improve several skills to get used to some courses; for the biomathematics course, there were weekly assignment, a presentation for no less than 45 minutes, class discussion, and preparing a project using some statistical approaches like Monte Carlo simulation. So I struggled with that course because of the lack of several skills. My statistical background was not sufficient; I needed to read more to know what to do. The course depends more on modeling and this was a new concept for me; I needed help and time to get along with it. I was not familiar with presenting,

especially in a different language and that was challenging for me. The course required lots of reading and I took much longer than what the native speaker usually takes to finish the same piece of literature. Finally, my biological background was limited as the last time I read a book in biology was in my high school. There are no such biomathematics courses offered in the university where I graduated”.

So generally, he needed to add some more to his mathematical quotient in order to catch up with the standard of the courses here. He did not find it difficult to adjust to the new system of education but to the new approaches of teaching mathematics. He needed also to learn more about computer programming. He said that working as a high school teacher for six years was not as helpful as lecturing in the university for one year. He found it more effective to be attached specifically to the university education. He needed some time also to adjust to the new culture, and that coincided with the time he spent studying English. He has two little children who need his care as a father.

Tuba stated that the main problem was the lack of resources in her home country, in addition to the lack of specialists in some areas of mathematics. Adjusting to the new culture was one of the issues. The language stood as a barrier side by side with her nature as a shy person. She complained about home sickness, especially the fact that she is here in Canada on her own.

Some of the students participated in this study have financial problems; that the income they receive for working as TA does not cover all their living needs. A group of the students suffer from living separately from their families. The students who live in Canada with their families have another type of social problem; that they have to take care of their children and be

responsible as spouses. Another group face difficulties adjusting to the Canadian culture, including adaptation to the food and making Canadian friends.

AS THE SOLUTION YOU APPLIED IS IMPORTANT TO US, YOUR SUGGESTIONS ARE WELCOME TOO.

At the end of the interviews, I asked the participants to explain how they overcame their difficulties and what advice they have for other international graduate students, so they could avoid having these problems. I asked them to provide some suggestions to the faculty too, as the main aim is to eliminate students' academic problems.

Vladimir has not had very serious academic problems; he said that all that he needed is to spend some time for adjusting to the Canadian system, which he likes. His main issue was the time. He was overloaded by doing so many things in limited times. So he sacrificed his enjoyment in the weekends and holidays to complete his duties. That's how he solved his problem. His advice to other students is to be patient and never think of withdrawing from the program. He said that students will experience hard times, but patience is always recommended. He suggested that professors must lower their academic expectations with respect to international students as those students are coming from different places, in which the culture and the educational systems are not similar to Canadian ones.

Tanya said that she asked some friends to explain some points to her. She also mentioned that she was reading lots of papers to understand the topics. Tanya thinks that she needs to get a part time job to solve her financial problems, but this seems like it won't happen

as she has to spend most of her time working on her thesis. She suggested increasing the rate for the TA work, or reducing the fees.

She said: “some professors are expecting grad students to lecture in the class a lot and I am not a very big fan of that because when I am taking grad courses, I want to listen to the professors’ explanations even if a student gives a good presentation. I don’t think I can rely on that; I want to listen more to the professor himself. Another suggestion- there should be some class hours for practical problems only. Some students are shy and not confident enough to go and ask the professor. If the professor or his assistant would present more practice problems it would be helpful for the student”.

Katrina overcame her difficulties by spending lots of time on reading. She had some discussion about the assignments’ problems with the classmates. In general, Katrina thinks that she is doing well and it gets easier as the time runs on.

Shazia’s main problem was related to technology; learning how to use mathematical programs was the solution for her problem.

She said: “I did a lot of practice during my Master’s education, and then, after completing my Master’s program at McMaster, I just took a break for one semester to prepare for my PhD level. I was studying other undergraduate computer courses to be ready for my courses”.

She likes studying in Canada, and has no suggestions for the faculty as she thinks that everything is good. She said that foreign students who are not familiar with the technology should spend some time to prepare themselves before starting their programs.

Mira's first reaction was to ask her professors about any ambiguity or any problem she had. When she needed more help with MATLAB, she preferred to seek a tutor.

She said: "I sent thousands of emails to tutors, I met a few of them and I figured out that they cannot afford sufficient help. I met one that was from engineering and working with MATLAB, and she told me the basic instructions like how to make basic commands; that was not what I was seeking and I went to the instructor a couple of times but he already was assuming that I know much more stuff, so I could not ask him to tell me from scratch. Although he was Indian, he came from a part of India where they do research for Master's and they did a lot of programming".

Regarding what she might suggest she said: "Professors shouldn't expect much of writing skills. They should give the students enough time to improve their writing, they should provide them with seminars or the department should conduct some seminars like how to write mathematical essays effectively. When you are taking a course and suppose the professor has 10 students in the graduate course, 6 of them are international, which is the usual case here, I think they should ask the students about their backgrounds personally and they should concentrate more like if their approach is different like even if you are from India, Pakistan, Bangladesh, Saudi Arabia and China

you have same problems or graphical approach of presentations so they can combine those problems and they can do something for that”.

As Saleh had not any problem with his courses, he only gave some suggestions to the professors. He said: “professors should not expect a lot from international graduate students; some of them come from poor areas where technology is not easy afforded. They should be patient with such students. I think it would be better if they establish classes teaching computer programming”.

Yuan was totally self-dependent. He solved his problem with no external help. He said: “I desperately needed help with C++ when I was doing the assignments of that course, but I didn’t know who I can ask or to whom should I go. That’s why I started to learn it by myself. I borrowed some books from the library and read them carefully and then I was able to do my assignments. Even for the program I used to solve my assignment with, I read more about it and practised more and more, until I was able to write the codes. It took me two weeks to get used to it. I finished the book within one week and then I started to apply writing codes. Before I came here I was using my lab top whose operating system is windows, and this is different from the system used in the computer available in my office. It is UNIX. So this was another problem, as applying the program in windows is different that applying it in other operating system. Before I came here I learned C++ and I was using windows. It took me some time to get along with applying

that program on UNIX. When I got used to that it was like playing games for me I gradually knew how to write huge projects”.

With regards to his social problem, he said that he applied for his wife and himself to be permanent residents; this problem will be finally solved. His other problems have been solved by adaptation. They took some time and now everything is good.

As a step to solving the financial problem he faced, Yuan said: “I suggest that our TA salary should increase a little bit. Otherwise, I cook for myself instead of buying from restaurants, I do a good job saving money, I just need to get more money from my TA work in order to pay for the increased tuition fees and for the place I live in as the rental range is getting expensive as well”.

As advice, Yuan said: “I think that so many Chinese students including me have a problem; that we do not have a social life. Chinese students communicate with each other in groups and most likely they do not try to communicate with others who are not Chinese. This is due to cultural issues and differences. I think it would be better for us to have friends from different cultures. This may enrich our knowledge; we can learn from others and we can benefit from their experiences”.

Lan tries her best to improve her accent. She also spends lots of time to finish her assignments and other requirements. She said that she is working on three courses together and

that takes so much time and effort. So she is trying to adjust to that by reminding herself of the great advantages she will get after finishing this beneficial program.

She said: "it is worthwhile to work hard and to be patient as long as I will get a good job in the field I always love".

Reema used to ask her classmates for help. She sometimes needed to find tutors to help her learn some programs. She contacted some friends in her home country to explain some points to her in Arabic. She said that she worked a lot to fulfill the program requirements. She had to learn some undergraduate courses to be ready for the courses at the graduate level. She spent more time learning how to solve mathematical problems using computer programs, and she thinks that she still needs to improve her English skills to be able to understand the lectures and communicate with others. She asked the faculty not to use "fancy words". By that, she meant that it would be better to use simple language with international students and never expect high English proficiency from them. Reema wished for international graduate students who have the same circumstances as her to attend pre-Master's classes first in order to get use to the academic environment and for refreshments purposes.

Ahmed communicated with some friends from other universities to solve some problems he faced in his assignments. He spent much more time on reading and on trying to catch up what he is missing. He worked a lot to learn how to write programs' codes professionally. He said that his problems have been reduced by the passage of time. He suggests that professors expect not too much from international students. He preferred that Saudi

students attend pre-Master's courses for adaptation purposes. He has lots of suggestions and recommendations to improve the education in his home country.

Tuba said: "I needed help but I couldn't get it because I didn't know how to get it. I didn't know also the students in my class and I am a shy person; that's why, I couldn't ask them before but now I ask; sometimes they answer and sometimes they don't. So I tried to do it myself. I spent lots of time reading and searching". She added: "professors can be more helpful to international students, they should understand their situation, listen to them to solve their problems. They shouldn't deal with international students as if they are from the same level as Canadian students"

Whereas the majority of participants asked their classmates for help with assignments, only few of them asked their professors for clarifications and help. The minority of them solved their academic difficulties on their own, for instance by reading textbooks and reviewing undergraduate material. With regards to the students' suggestions to the faculty, most of them mentioned that professors should not expect a lot from international graduate students, especially with respect to the language proficiency; that international students come from different cultures and backgrounds and need time for adjustment as well as for improving their English skills.

Reema suggested that students who have limited background knowledge or those who have been away from practicing math for a long time should attend pre-Master's courses- courses at the undergrad level- in order to be well prepared for the graduate school.

Students who complained about their financial situation suggested either increasing TA salaries, or reducing the tuition fees.

Now I will review the results of the faculty members' interviews. I want to inform the readers first that I only interviewed three faculty members even though I had planned to interview four to six of them. In fact, from the three interviews I conducted, I got an impression about what I might hear from other professors. Professors tend not to generalize or even give detailed information. Most of their answers did not indicate any noticeable problem regarding the international graduate students. This will be shown clearly in the next few lines.

DIFFERENCES BETWEEN EDUCATIONAL SYSTEMS IN ONTARIO AND THE U.S.

I found that all of the professors I interviewed worked for a while in the U.S.A, so I asked them about the differences between the educational systems of both countries.

Dr. Bernard said: "There is not so much difference between US and English Canada. One difference is maybe the emphasis on text books; in the US, there are so many big

classes- so when they teach, they usually follow the course text, while here at McMaster, I observe sometimes that the lecture doesn't correspond to the text books.

Does that mean in the U.S. you have to follow a specific outline for your course but here you have flexibility you can add whatever you want in them?

Dr. Bernard: "No, here it's less flexible; you have to have a syllabus at McMaster; and this is very precise; that all information must be in it while in the U.S.A. there is no need for the syllabus but there is a text book you have to follow not line by line or section by section but with the course; students have to be clearly defined we always look for the examples. For example, in 3rd year analysis class, there is a text book but it's not so well defined somehow its less precise".

Dr. Harbour: "Yes, my impression when I first came to Canada, after teaching in the US, is that Canadian students in general seem to be better prepared in terms of being disciplined, in writing in particular; so the homework they hand in is better presented, is more organised, and the students have more experience in giving presentations for example than students educated in the US".

Dr. Nelson: "Of course I would say US is a big place although it's more similar, but not identical to our system; it's different from other places and more like ours".

All three professors agreed that the differences between the Ontario educational system and the American educational system, as far as tertiary education is concerned, are minor.

ABOUT THE COURSES THEY TEACH AND METHODS OF ASSESSMENT

I wanted to know what courses my professor interviewees usually taught. I got the following answers:

Dr. Bernard said: "The classes were mostly 3rd year, 2nd year...let's say everything except 1st year, and I also teach graduate students. So far I have never taught a specialized class, I have always taught basics such as fundamental analysis or fundamental PDE, ODE but I was never given a special topic like functional analysis - this is not offered anyway, but I have never taught more specialized topics. I always taught the basics here.

Dr. Harbour said: "I have taught graduate algebra and the graduate model theory".

Dr. Nelson said: "basic algebra courses, algebraic topology, older version of algebraic topology, and the groups 6TB which is topics in algebraic topology".

The next question was: "What do you think is the level of difficulty for each of these courses? Are they too difficult, moderately difficult, just right or easy or too easy?"

Dr. Bernard: "No I think they are not difficult for the graduate students. I think that the international students are better prepared than our Canadian students and our classes are geared towards our students with the background they have; so in general I don't think so. I actually feel sad that there are not enough classes and the choices are very limited".

Dr. Harbour: "There is so much variety you can't make a generalization like that. For example 1st year calculus students here have a more standard background so the majority of our students went to high school in Ontario which means they have seen Ontario high school standard courses. In the US, students are from all over the country and therefore they have no standard curriculum for the high school courses so they have much more varied backgrounds. Some of them are extremely good and have very strong backgrounds and some of them have very weak backgrounds. However, I think level 7 courses are appropriate for graduate students. Of course students come from different backgrounds and so a student who did undergraduate work focusing on analysis more than algebra maybe needs to take a level 4 or level 6 course in order to be prepared for level 7 algebra course. So I think we should not expect all students would be the same. As well, not all of them are ready to do this at the same time and we should have different expectations. I don't think we should bring the graduate course level down to meet the needs of the students because there are other courses available to meet those needs. We should rather advise our students to do well as what courses they need to complete are considered to be at the graduate level. It's the balance".

Dr. Nelson: "Well you see all these courses have the same intention like 701 and 702. Those are supposed to be basic algebra courses for beginning graduate students, whereas a course like 766 is more advanced. They are not all the same. Because we have some courses which are general mathematics education for our graduate students. Then we have more specialised courses".

All three professors stated that they thought that their courses are appropriate for graduate students. Dr. Nelson said that not all courses are the same; some of the courses in his area of specialty are easier as they cover basics, while others are fairly advanced.

“What do you think about the content of the courses? Is it intensive? Good?”

Dr. Bernard: “The graduate classes are intensive. We meet about 3 hours a week and there are only 12 weeks; so it’s about only 36 hours and we are supposed to introduce the whole topic of analysis or PDE; so it has to be intense. I think it makes sense. It shouldn’t be too intense that the students have to be able to still right to learn, but in term of intensity it can’t be too relaxed; then the students won’t learn much”.

Dr. Harbour: “I haven’t taught enough of them regularly enough to give a solid answer for that. I taught algebra one time and I think that what I taught was reasonably solid. I think that graduate courses should be intensive. They should be taking a lot of student’s concentration and focus so we should have high expectations of our students and we should ward them for working hard and doing well. Now there is a certain amount of frustration on logic, which is my area, because we don’t have an offered graduate course and it’s not regularly taught; so we don’t have a history of doing it. But that’s a sort of chicken and an egg problem; that you may offer the course, but you cannot expect how many students want to add it, and if you do not offer the course, some students may need it”.

Dr. Nelson: "I think the core courses are pretty standard for what is given in North America so you might see the same course in any research university in Canada and the US".

While Dr. Harbour and Dr. Nelson think that the courses' intensity are pretty good representing the standards that should be provided for graduate students, Dr. Bernard thinks that the courses are intense. She said that 3 hours a week for a period of 12 weeks are not enough to cover many topics of the course in sufficient detail.

Do these courses support students in their thesis/ project work? If yes, please tell me how?

Dr. Bernard: "No, I don't think we have enough classes; for example, in PDE it's absolutely essential to have a class in functional analysis and we have none; we don't have functional analysis. In every department there is always a functional analysis class. We have only offered this class once in 20 years so this is a serious lack".

Dr. Harbour: "Well the graduate courses that we do have provided basic training for graduate students for somebody who wants to go on to write a PhD in its specific area; students need more advance training and we don't have enough students in one area to teach a course; so they do have to learn through reading courses, reading books and papers to set to that advanced level".

Dr. Nelson: "Well at some point there is a limited value of each course, sometimes the better way is to learn through a project; as I am supervising some students, they typically come to my office once a week and we talk about things for an hour or maybe

two. My PhD students even take longer so they are learning a lot that way; so it's just a different way of learning. In some ways, it is more close to actual math what research is like; I mean in courses we give you the subject, exercises and all that but it's not quite the same in mathematical research to understand problems, or how you should be thinking about them; that you don't learn in a course. They learn more in a project because project involves doing a research and courses, which are two different ways of learning. Projects give them a chance to accomplish something".

All three professors agreed that the graduate courses offered by the department are not enough for the graduate students in terms of preparing them for future career as professors, and to provide them with the sufficient knowledge for their research. Dr. Nelson thinks that the projects require that the students prepare for the meetings with their supervisors, which means that independent reading is important for research work.

What do you think about the methods of assessment used to evaluate students' achievement? Are they effective? Why?

Dr. Bernard: "Recently in real analysis we are preparing the students for comprehensive exams; the chair of the graduate students recommended we do in- class tests. So I did that once for real analysis; I did 2 or 3 in class short tests and then a final exam. It was really like an undergraduate type of evaluation compared to assignments and take-home, but that should be done in basic graduate classes like PDE or ODE for preparation purposes. I do think that an in-class exam is very efficient way to prepare the students; it motivates them really to learn, but as a teacher I prefer take- home and practice problems. Somehow students have time to read and go further in discussions between

them and I encourage them to have discussions. I think it's very nice, but at the end when you want to make sure that the student individually understood specific topic in order to do well in an exam like the comprehensive one for PhD, an in-class exam is the most efficient. It should be very basic not tricky questions, making sure that there is a minimum that is learned by everybody".

Dr. Harbour: "it depends on what you want to achieve with assessment. In my opinion, I want students to learn and then I hope that assessment is only an acknowledgement of what they have learned; in terms of this, the effective method is homework; it is the best method for learning. I prefer take-home exams because I want students to think through long and hard problems and I don't think a 3- hour exam is the way to judge the ability of students".

Do you think that take- home exams prepare the students for the preliminary and comprehensive exam?

Dr. Harbour: "No I don't think that those are the way to prepare for preliminary exams but students should prepare for preliminary exams by practising on similar problems to the one they might see in the preliminary exams. So I would say studying for the preliminary exam is different from studying for a course exam.

Asking Dr. Nelson about the method of assessment he said: "There are several ways of assignments, midterm exams, formal sit- down finals, take- home finals and then there are projects, presentations. It depends on the nature of the courses; for 701 and 702, which are basic algebra courses, I would have a midterm exam and final- the final could

be a take-home exam, whereas for algebraic topology I would prefer projects and presentations. So it depends on the type of graduate course. They are not all the same. We have some courses that are for general mathematics education for our graduate students. Then we have more specialised courses”.

What about other methods of assessments like presentations or projects?

Dr. Bernard:” I indeed prefer for the students to do research more in order to learn more. I love presentation; although it’s a lot of work for me because I have to think ahead- I have to prepare my class instructions where the students can understand in advance because they have to have the material before they present. So I have to plan quite a bit in advance and I have to choose problems that are not too difficult so the students don’t take too long or too short a time because that’s comparable. After a while, students can compare with each other so I have to make sure that no one of the students gets something much larger than the other so this is something they will expect from me. It is good for students to be forced to present; presenting something is really a way to make sure that you understood it. You may think that you understand when you are writing but then when you have to explain it to somebody else that’s the real test; so they have to learn the material so that they can express their understanding mathematically to the audience in the class. On the other hand, a big part of the lectures should be professors’ teaching, and a small part of it is students interacting in the class”.

Dr. Harbour directs reading courses sometimes; so she expects the students to discuss and ask questions. She really wishes that students in all classes would ask questions so that they can learn more, but unfortunately, the students tend to be quieter in the class.

She said that she did not assign her graduate students to present in any of her courses; she said: "Well it's again one of these methods to help students to have mathematician skills; that at some point they have to learn how to do it and so they learn it by doing it and by being given advice".

Dr. Nelson prefers to assign the students to do projects and presentations in higher level courses; this work helps them to prepare for future teaching.

Professors recommend take-home exam for graduate students as it motivates the students to read more and deal with higher level mathematical problems. On the other hand, Dr. Bernard said that in-class exams are beneficial in terms of preparing graduate students for their preliminary exams; therefore, she does them. Dr. Harbour thinks that students should be responsible for preparing for their preliminary exam, and this should not be combined with the course requirements. Dr. Nelson uses in-class exams with the core courses that cover the basics; otherwise he uses methods like presentation and projects with more advanced courses like algebraic topology. Dr. Bernard requires that, for most of her courses, students give presentations, as she thinks that this method is more effective, leading toward deep learning. Dr. Harbour did not ask any of her students to present.

Then I asked: "Have you taught or supervised international graduate students?" and: "Are they too many? Do you think they represent a big part of the class?"

Dr. Bernard: “Yes I have done both and in terms of supervising I have had only one local person -otherwise they are all international but they are not that many.

Dr. Harbour: “yes, I think in general we have more international students than Canadian graduate students. I don’t think they are too many. I just think we have more international.

Dr. Nelson: “Well I have one student in a Master’s program from China. In terms of graduate students, I have quite a lot maybe dozens of them. Most of them are Canadians so far but I haven’t really supervised a large number of students. Maybe I have half a dozen Masters’ students and one PhD student”.

All professors I interviewed have taught and supervised international graduate students.

INTERNATIONAL GRADUATE STUDENTS’ PROBLEMS

I started inquiry about international graduate students specifically; so I asked: “Have you noticed that these international students have obstacles or struggles with their graduate courses as compared to the Canadian students?”

Dr. Bernard: “hmm... let me think. Well you were the one who opened my eyes when you told me that it was your first time you had a class with me and you said you were not used to the handwriting; it was hard for you to find out what was written on the board and you couldn’t understand, but now you are comfortable with the handwriting. Indeed international students have problems here- they come from different countries

with different languages like Chinese so I would assume in the beginning they find it difficult. As compared to Canadian students, on average some are better than other students; they are always at least as good as our graduate students. Actually, when international students come here, they are really determined, they know what they want, and they are ready for it. I think they do very well”.

Dr. Harbour:” No, on the contrary I think we need to make a careful distinction here between international and native students. I have worked with American students who were native English speakers, with foreign students who are not native speakers, and also Canadian students who are not native English speakers; so there is a distinction here. Of course we have to consider the background with language. My feeling is that I hate making generalizations. I have one PhD student who is American, one PhD student currently who is from China, and one just starting who is from Iran. The American student did fairly well, but maybe she is a little weaker. The Chinese student is doing extremely well. I think he struggled with the language in the beginning but I think his English is excellent now. Certainly this is an issue for some students; they have to learn English as well as mathematics at the same time, and we can’t do anything about it. It’s just a fact of life. However, Chinese student certainly didn’t struggle with his courses. Regarding my Iranian student, I don’t know yet as he just started. With regards to the students I teach in class, I do not know if someone has struggles! Among the students I supervised few years ago, who are not native speakers, their backgrounds from their respective countries are probably good enough for them to do graduate level work here in Canada. My feeling is that they are better trained than the Canadian students. The

trouble is that it's hard to generalize because we don't have a big pool so what I think is that among the students who come to study statistics we generally get a weaker group- they are often international so I can feel that they are a bit weaker. Otherwise I think the students who come to us worldwide have already made a big effort to go to a new country and that generally means that in order to achieve that level of ability to make this transition they also achieve high level in their mathematical studies"

Dr. Nelson:" Occasionally, I saw that but mostly they seem to be doing ok. It's the same case with Canadian students too. We expect sometimes that they do well most of the time. They do well, but if their background is not as good as we think, students may struggle. In fact, even Canadian students may struggle; this could be for various reasons. I didn't see any big distinction between international and Canadian students. Maybe there is a similarity among all the students of the whole world. Graduate students have desires; they are more motivated".

Generally, the professors do not think that their international graduate students are struggling with their courses. They do notice, however, international graduate students' limited proficiency in English language skills.

THE LACK OF ENGLISH LANGUAGE PROFICIENCY

Does the language represent a barrier for the international students especially in presenting? If yes please tell me how?

Dr. Bernard: “Actually no; this is what is nice about mathematics; it’s nice for international students to take mathematics here that there is no such huge emphasis on language. Yes, there is communication in English, but in mathematics there are formulas that you present either in French, English, Chinese, or Italian; basically the board is about the same. So I haven’t noticed any; I mean not really. They do have all sorts of accents but that’s not going to change my understanding. In fact I like to have all these different accents, it’s much more joyful. I like a variety of expressions. Some people are shyer than others. All graduate students, international and Canadian, are capable of being equally good. I notice that some international students are not so comfortable in English in terms of understanding, so they have to work harder to catch up but I haven’t noticed that they do less well”.

Dr. Harbour explained her point of view with regard to the above.

Dr. Nelson: “I think that’s a case for most of my students. It’s something that they are a bit shy about because maybe they don’t want to tell me that they are having problems with the language. They have a little trouble understanding the way I speak English because my accent is funny; so yes that’s true but on the other hand it’s hard for the professor to figure them out sometimes. Anyway, everyone seems to know most of the mathematical terms. They know what we are talking about so we can write the equations on the board and the lecture goes well”.

The lack for proficiency in language skills can be noticed by all professors, although they do not consider this to be a big problem, as the students are hoped to improve their skills with time.

DIFFERENCES IN EDUCATIONAL SYSTEMS

Do you think that the international students are unfamiliar with the educational system here? How do they pick courses?

Dr. Bernard: "Well, you said that your educational system was different, otherwise I cannot really know if the students struggle because of that".

Dr. Harbour: "It's very hard to see where the issue is; I mean students come and they don't know what to study so they want to have a little bit of everything. I think that is perfectly reasonable. They can come and they know exactly what they want to do and they just say I am going to take these two courses and you have to say you should develop a greater depth of knowledge. On the other hand students may come and don't know what the course is like because they don't know how to read the course description".

Dr. Nelson: "I don't have a good answer for that, it varies; they come from all over the world so I don't think I can make any generalizations".

The faculty members cannot give a definite, detailed answer to this question as the students do not discuss their problems with them.

Have you required your students to use some of maths programs like MATLAB? Do you support the idea of using those programs in the graduate courses?

Dr. Bernard: “No, If there is some sort of help you know if a student comes and they have to know this program to be able to take the class, then that’s a bit unfair for me unless there is some sort of help; for example, there could be a TA who is there who has information and examples about the program on the web, and then the students can learn. It’s good to be able to program and stimulate what you believe is true. It’s good to be able to have this extra way of checking things but the teacher who uses it should be providing examples, manuals also they don’t really have to explain the whole thing- if there is an example it makes it much easier”.

Dr. Harbour: “for my courses, no. This is an issue in the department but they are working on it. We say we should be teaching our students how to use computer programs. It’s because we are not teaching them. Some of them know it depends on the course they take. So we are always looking for graduate students who know it and can teach it, we need to train our students to teach our undergraduate students”.

Dr. Nelson: “No I have not. I think that doing certain kinds of math required such programs. In this case, I think the professors should improve the courses if they are using any type of programming. In number theory, maybe we do not need them, but they are not restricted to be applied on mathematics courses; if you want to do a PhD in algebraic topology, you may want to use some computer programming for equations”.

The professors interviewed do not require their students to work on any type of math computer program or software. However, they indicated their opinion about it. Dr. Bernard said that if a professor required such a program to be applied, then s/he has to provide examples and tutorial sheets in order to help students who are not familiar with these programs. Dr. Harbour

indicated that there are future plans to specify classes for teaching computer programming and the use of software for graduate students. Dr. Nelson recommended that I ask the professors who have embraced the use of technology in their courses for more details.

THE TIME GAP BETWEEN EARNING THE LAST DEGREE AND STARTING THE CURRENT PROGRAM

Have you ever taught older students in their thirties and forties? I mean those who have long gaps in between the last degree they had and the current program they started. Do you feel they were forgetting their background or not attached to studies?

Dr. Bernard: "No, maybe a few students; I cannot remember".

Dr. Harbour: "Yes I have a few not many; usually they do have gaps I try to advise them how to fill in those gaps".

Dr. Nelson: "yes, I taught a few of them. They have to catch up a little bit because they forget a lot in that gap. Some of our students are older so I recommend them to take undergraduate courses just to get them back up to speed. They may be taking a similar course they had 10 years back so we recognize it's a challenge for some students but I think it's good for students to come back to studies after a long gap. It seems like a good thing to encourage them so it might take a little longer for them but I think students have different situations".

The professors taught a very few of international students who had a time gap between the start of their graduate work at McMaster and the previous study in mathematics. They mentioned a few recommendations for those students who need to fill up the gaps in their knowledge.

THE BACKGROUND OF KNOWLEDGE, IS IT SUFFICIENT?

Did you find them coming to you for more clarification, more questions than the others, or are they seeking help elsewhere? Do they talk about their struggles?

Dr. Bernard: "No; they do not come. And they do not tell about the obstacles they have. Maybe there were students who didn't do well in my class and had problems but you were socially open; you were able to discuss your problem. Well it's not frequent that people have the same amount of courage; not all of them are comfortable to discuss things with their teacher, and so there are other cases of international students but Canadians as well don't do as well. With regards to seeking help elsewhere, I don't think so, I think they come very well prepared actually that's what I think. They do have to work very hard but everybody has to work hard so I think they seem to do well. At least that's my experience so far".

Dr. Harbour said that students usually do not ask questions either in the class or in the office hours. She would prefer if they come and ask. She said that she cannot know about their struggles as long they do not talk about them.

She said:" It's not easy to figure this out; you have to work with the students for a while and start to realize that there is something that they haven't got; maybe it would be

better if they have it in the previous course. Then, of course I would give them suggestions, books to read in order to bring their work up to the correct level”.

Dr. Nelson:” they come sometimes to ask questions, but they do not complain; it’s pretty rare. I am sure it has happened but very rare”.

Have you ever had anyone who just passed the course with a minimum?

Dr. Bernard: “in rare cases, I had students who pass with B-, but they are not necessarily international”.

Dr. Harbour: “This is pretty rare”.

Dr. Nelson: “Yes of course, but that does happen for Canadians as well. It is rare; typically we have 1 or 2 students like that but not a lot”.

Do you think some international students need to learn more undergraduate courses to be well prepared for courses? Why, or why not?

Dr. Bernard: “Some international students when they don’t have real analysis background they are encouraged to take their fourth year class which is also analysis 2 that is helpful for them in term of preparing for comprehensive exam, but again I haven’t noticed any particular problem”.

Do you think two courses of analysis at undergraduate level are enough to provide the students with the sufficient knowledge they need for graduate school?

Dr. Bernard: “No, I do not think so”.

Back to our main question about graduate students' need to learn more undergraduate courses,

Dr. Harbour: "Yes some people do need that; maybe because they did not have enough courses in some specific areas, but they are not many".

Dr. Nelson: "I think regardless of where they are from even our Canadian students if they have a gap in their background I think taking some of our level 3 and level 4 courses would be a good thing too, filling the missing pieces. We do ask certain students have weaknesses and problems to go take some level 3 courses. It might take a little longer for them to do the degree. But I guess that is right".

In general, professors agreed that international graduate students seem to be doing well; they are not less knowledgeable than Canadian students. Passing the courses with the minimum grade occurs rarely among graduate students, and specifically not with international students. For some graduate students, undergraduate courses are recommended to be reviewed, but again, this is not only for international students.

Do Canadian students have problems with the courses as well? Do you think these courses are difficult for Canadian students as well? Do you think undergraduate programs will prepare students for graduate level?

Dr. Bernard: "Well, I am not sure...I think everybody is obliged to take fourth year analysis if they go to graduate school, or maybe I think they are obliged to take third year analysis class to be able to access the Master's level so that I would have to check. If they do not take this fourth year analysis then I don't think they are ready for our

graduate program. Even if they take 4A (Analysis for fourth year), actually it's not quite enough. I find in general that they seem more to have pure algebra, number theory, and ODE; it makes them pretty well prepared for graduate school, but some of them do not take enough courses in analysis which is a background for all PDE, ODE. I think they would need another class".

Dr. Harbour: "The minimum level for a first degree in math is not enough in order to go to graduate school, but we have undergraduate students doing the degree at all levels so the minimum requirement is designed for students who just want to get their degree and leave. Students who want to go on, we definitely advise them to do more, how many courses, and on what level of courses they should be taking in order to prepare themselves for graduate school".

Dr. Nelson:" Of course it is better if the students decided early to go to graduate school. I mean it helps to have certain courses like differential geometry and maybe other courses. For example, if you are going to say numerical PDE or something like that then they do have to think a little bit about the courses they are taking as an undergraduate in preparation for graduate school. However, we do want students to change their minds and attend graduate school, and I think there is time to make it up and get courses".

According to the professors, even Canadian students may not be well prepared for graduate school; some must complete necessary prerequisite courses in order to be able to study graduate courses.

WHAT ABOUT TA WORK?

Do you think TA work is good for students even for international ones? Why or why not?

Dr. Bernard: "TA should not take up too much of a student's time. I find it often takes too much time and then the students are not able to do what they supposed to do. The real idea is to do the research. The point is that one has to be careful with the TA work. One has to be careful that the load we give to the students of grading in particular should not be demanding. For example, in the grading assignments of calculus we had this huge class with assignments. The first year calculus is kind of not interesting for graduate students, it's very basic maths and they have to go through like checking answers; it doesn't make sense. Now we have web assignments that are automatically done by the web- that frees up the graduate students. Maybe the fees are much more expensive for the international students; so they do need to do TA work, but what I would like is that one gives them grading tasks in the 1st semester or the 1st year, but not too much, and then it is better for them to help the students in the math help center and give some lectures. In terms of experience, it's better for everybody, especially for graduate students- doing tutorials and MATLAB is good for them heading towards their PhD. But if it wastes their time it's not good."

Dr. Harbour: "Well it gives them a salary. Financially TA work is the way we support our students. We couldn't afford to bring students in and just give them money without asking them to do TA work. Besides, it teaches them how to teach. So it's a part of their

learning program. There's a distinction between the Master's students and the PhD.

Most students doing PhD's are interested in TA work. Marking is very boring; everybody hates doing it, but it has to be done and it offers a salary. It's stressful but it's a part of learning how to balance your work and knowing what your workload is; so maybe this is another issue as well. It's a question of balancing and that's part of growing up. The amount of work carefully regulated; 10 hours a week for each student and not more. So if the student is working more than 10 hours a week it's their own finding that the work is taking more time than it should; they need to communicate with the professor about it because it's again a question of balance.

Dr. Nelson: "Well if they are going to have an academic career, then they need to be able to teach students, and being a TA is how you learn that and how to interact with students. So I mean if they are doing research and they don't ask the students, they might get in trouble. Teaching for the first time is actually a good attempt; so we do TA work as part of the training for our graduate students. It might be a little bit stressful on students who haven't done it before, especially if there is language problem. I do think lots of TA work could distract them from studies because they have to work more to get the money; this could be a problem".

TA work is useful for graduate students, helping them to improve their teaching skills. However, the students should not be overloaded by such tasks, so that they do not affect their academic performance. Marking might be boring for most of the graduate students; assigning them to do more teaching is more interesting and beneficial.

TELL ME FREELY WHAT DO YOU THINK ABOUT INTERNATIONAL STUDENTS' ADJUSTMENT? AND WHAT SUGGESTIONS DO YOU HAVE?

In what ways do you think international students need to adjust to the environment here? How much adjustment they have to make?

Dr. Bernard: "I don't think more than what we discussed; the handwriting may be different- that's a serious adjustment, and of course the culture is different. There need to be adjustments in language as well because- as you said- they have to adjust to math language, and reading maths can take longer so there is definitely a real adjustment. On the other hand if students come from a very good background, they have the advantage of seeing many more analyses for example. This advantage will give them more time to adjust than the other students who have to learn analyses. So this might be compensation depending on how good their background is".

Dr. Harbour: "The most important adjustment is to realize that the faculty in general is accessible and how you need to make use of that access. Faculty expect students to come and talk to them and that's the big piece of learning; that personal interaction is definitely an adjustment".

Dr. Nelson: "I don't have a good answer for that; it varies. They come from all over the world so I don't think I can make any generalizations".

The great suggestion for international graduate students is to discuss their problems with their professors and to benefit from the university's resources. International students'

language skills will improve gradually; it is important that they enrich their knowledge and try to fill up the gaps they have in their background.

Is there something important we missed or is there anything else you think I need to know to improve the graduate program in Canada?

Dr. Bernard: "Oh I think we need more classes and it will be good if graduate students teach at the end of the PhD and the Master's. I think every PhD student should be given a class so they have the experience of teaching; I think it's very important, but in terms of improving this graduate program I think more classes would make it much nicer and helpful for students who do the comprehensive exam; not the preliminary as it covers the basic. As for international students, I think they do very well and they are integrated well. I hope they enjoy the process of adjustment. It's the entire success story.

Everybody seems to be doing well understanding. It's not a failure to me; it's more like a success, and it doesn't depend on being international or domestic".

Dr. Harbour: "I think that the most important thing for a student to be successful is interaction and communication; there is nothing one can do really. The faculty have to communicate with students and students should communicate with faculty. You just have to keep on trying all the time and remind people what you have to say. One important question you should have asked is the difference between men and women; this is an issue that is culturally dependant".

Dr. Nelson: "No I must say you have everything covered".

It is vital to add more specialized courses for graduate students as the current courses offered by the Department of Mathematics are not sufficient to provide the future specialists with adequate mathematical knowledge. The communication between the faculty and the graduate students should be deeper, in order to help solve some problems faced by the international students.

CHAPTER 6

DISCUSSION

From my initial analysis of interview transcripts, I found that the results I anticipated have been confirmed-in addition to other results. Gathering the data and analyzing it, I am able to construct a theory that describes what reasons were behind the participants' struggles with mathematics courses at the graduate level, and how to overcome these struggles. Although I interviewed students from only two universities, the similarities of mathematics graduate schools in Ontario allow me to conjecture that my conclusions apply broadly to many universities in Ontario. Some problems discussed in this study are short-term problems, while others may take longer time to be resolved.

The lack of English language proficiency is one of the reasons for the students' difficulties with math graduate courses. Despite the fact that those international graduate students have satisfied the language requirements of admission to graduate school, some of them are still not well prepared to study mathematics in English-speaking universities. (Zhou, 2010) mentioned that "most international graduate students reported feeling some level of frustration at meeting the high level of academic English requirements, in particular, academic jargon and scholarly writing". In fact, most English language institutions that teach academic English courses and offer English language proficiency tests such as TOEFL and IELTS do not cover mathematical topics. As I previously mentioned in the literature review, (Xu, 1991) suggested that "standardized tests such as TOEFL may not measure the language dimensions that are important for academic purposes". Also, (Jiménez, and Leichnetz, 2004) mentioned that 'although most

schools require a certain proficiency level in English as measured by the Test of English as a Foreign Language (TOEFL) that is not always a good indicator of the student's ability to function in the classroom".

Seven of my interviewees struggle with giving presentations because they are not fluent enough to give a mathematical talk. However, difficulties in presentations were not only due to the limited ability to speak; other factors like unfamiliarity with the concept of presentation as a method used to evaluate students' achievement, and shyness, played a role. Four students indicated that reading textbooks takes a long time as they are not as fast readers as native speakers. Two of them mentioned that it was hard for them to understand the professor's lectures; those specifically are from the group who received their undergraduate education in their mother tongue. It was problematic for them to understand because they were not used to mathematical language. In terms of writing, no one complained, as completing assignments does not require advanced skills in writing. Most students indicated that the main issue with this regards is writing their thesis or projects, but this is not the issue we are concerned about in this study. Professors who participated in this study stated that the language difficulties that international students usually have are noticeable. The students improve their language skills with time. However, (Jiménez, and Leichnitz, 2004) mentioned that "the importance of adequate language skills cannot be overemphasized for the international graduate students whose native language is not English and who as graduate students have to defend their views in class discussions, participate in classroom activities, and write lengthy research papers".

The educational systems of the previous institutions in which all my participants studied are not typically the same as compared to the Ontario educational system; some are distinctly

different, whereas some are close to it. However, each system embraces diverse types of teaching and evaluation methods. (Meleis, 1982) stated that “two characteristics of American education that particularly influence students' performances are the differences in the structure of the curriculum and the presence of optional electives, notions that are completely unknown to the Arab student”. In fact, not all participants were complaining because of the differences between the systems. While the Saudi graduate student, Reema, had difficulties in figuring out how to select her courses, the Russian student Vladimir stated that he only needed a little time to adjust to the new system, which he likes. This leads me to say that students are capable of adapting themselves to new systems as long as they believe that these systems are beneficial for them. The faculty members I interviewed agreed that it is not easy to detect international graduate students' problems that are related to the differences between educational systems, as international students do not usually discuss such problems with their professors. In general, the differences between educational systems are problematic when the previous system does not prepare the students for further education abroad. It is important for these institutions to provide a strong knowledge basis that meets higher education requirements.

Adopting technology in teaching is also significant in terms of preparing qualified individuals who can study fluently in foreign universities; the lack of computer technology skills is one of the reasons that hamper students from succeeding in their mathematics courses. I interviewed a group of international graduate students, who are knowledgeable enough to solve their assignments' questions, but disabled by their feeble technological background. From the data we collected for this study, nine participants were required to use mathematical computer programs. Six out of those nine had difficulties with writing and interpreting computer code.

Some students said that they studied programming courses when they were undergrads, but they were not required to apply what they learned to solve mathematical problems. They now needed to review what they previously studied and do more training on code writing. According to these participants, this revision and training process was not difficult, but stressful as they were overloaded having this extra work to be done. Some indicated that they studied very old versions of programs such as FORTRAN; which means that their courses had not been upgraded for a long time, and they lacked the ability to implement code writing on mathematics problems. Moreover, some mentioned that they have never used any kind of computer programs; that they used to solve all mathematical problems manually, and so they needed to attend classes or find tutors in order to catch up with the advanced approaches they faced. Although professors who participate in this study do not require their students to work with computer programs or software, they provided us with helpful suggestions. Dr. Harbour mentioned that faculty members in the Department of Mathematics and Statistics at McMaster University are planning to offer courses for teaching computer programming, and it is suggested for these classes to be directed to professional graduate students. According to Dr. Bernard, professors who implement of computer programming in their courses should provide examples and detailed instructions of code writing in order to help the graduate students who have limited technical skills.

One other issue was mentioned by a few of the participants is that in their home countries, they studied similar topics to the ones they had in their graduate courses in Canada but with different approaches; this made it harder for them to catch up with the professors in their graduate courses. One of the interviewees, the Saudi student Ahmed, said that he studied the same course in two different Ontario universities with two different mathematical

approaches. The numerical analysis he completed at the University of Waterloo was algorithmic or computational based, whereas the same course is offered at the University of Guelph and it is taught using a theoretical approach. No doubt it is beneficial for the students to learn the same material with different approaches, but it might be difficult in the beginning to get used to the new methods. Looking at the Canadian undergraduate calculus textbook, the Indian student Mira mentioned that the rule of integration by parts is formed in an easier way; although she studied the same concept in her home country, she found it complicated as compared to what Canadian undergraduate learn. This issue may lead us to discover another problem; that in some universities in different countries, the various syllabi have not been updated. The professors at these universities are traditional; they stick to old textbooks, which are not compatible with modern trends. This reminds us again that ignoring the involvement of technology in teaching some mathematics courses is probably not a good idea.

While faculty members who participated in this study stated that there is no distinction between local and international graduate students; that all seem to be doing well, some of the participants mentioned that the courses they studied in their undergraduate school were not covering all the basics the students need in order to be qualified for graduate school. The Saudi student Reema said that her major was mathematics with education. She used to have seven courses every semester; three of these courses are mathematics and the other four used to be educational. All mathematics courses she had were mandatory, but they were not intensive. She had in total 26 courses; two of them, for example, were real analysis. According to Dr. Bernard, two courses of analysis are not enough to cover what a student needs for graduate school.

"In the Arab educational system all students enter a structured program and proceed systematically through it without being given any opportunity for the selection of electives other than the choice of a major; even this is determined by the student's grade point average in the last year of high school"(Meleis, 1982). Reema confirmed this as she said that students are obliged to complete all the courses set by the faculty, and there is no selection of optional courses that students can add if they are planning to attend graduate school, which means that the students have to read independently in order to enrich their knowledge in a specific area of mathematics. Furthermore, the available resources are written in English; so we go back to the language barrier again. Most of the students who graduated from the same college as Reema lack proficiency in English as it is not the language of instruction in their institute. So the problem is students with a limited background of knowledge, in addition to a weak ability to learn independently- because of the language barrier.

The Turkish interviewee indicated that not all universities in her home country have the same educational standards; that the universities located in big cities like Istanbul have a more advanced system, more courses and qualified professors. However, Tuba did not come from a big city. She emphasised the lack of resources as a big problem in mathematics education there. She did not study mathematics in English; and so it was hard for her to learn more from English books at that time. In fact, she hinted at another important issue when she was telling her own story; that some students graduated, planning not to continue their higher education; they only study the required courses that allow them to graduate as high school teachers. Later on, when they suddenly decide to attend graduate school, they discover gaps in their knowledge so they suddenly need to study more specialized courses. Hence, the struggle begins when they try to

learn more in order to fill in those gaps at the same time they fulfill their graduate courses' requirements.

Students may find difficulties fulfilling the requirements of their graduate courses. It is known that those requirements were designed for assessment purposes. Most international graduate students like the methods of assessments used in their Canadian universities, but their complaints with this regards are due to unfamiliarity with those methods; Take-home exams, presentations, class discussion, projects, and assignments may represent obstacles for some international graduate students, who have never done some of them in their home countries.

Some of the students did not have take-home exams before coming to Canada. In addition to the professors I interviewed, most of the interviewees confirm that a take-home exam is an appropriate way to assess graduate students in particular; such an exam allows the students to do more reading, searching, thinking, and linking information. Graduate students need to delve in more depth into mathematical problems and the in-class exam is not the appropriate way to do so. The interviewee from the University of Guelph indicated that most of their exams are in-class as the department offers only level-6 courses for graduate students. According to Dr. Bernard, in-class exams are useful in terms of preparing the graduate students for the preliminary and the comprehensive exams, but it is not the appropriate way to encourage the students to learn and search. Dr. Harbour thinks that graduate students should work independently preparing for their preliminary exam besides studying their graduate courses.

Exams are not sufficient to measure students' achievement and do not help to improve students' learning outcomes. Other methods of assessment such as assignments, projects, and

presentations should be used in order to enhance students' understanding and lead them to deeper approaches of learning. One of these methods is presentation. According to our professor interviewees, it is good for graduate students to present topics as this is a way of preparing them for their future careers. Four of the participants have never presented before when they were undergrads; their first experience was in their graduate school in Canada. No doubt their limited presenting skills stood as an obstacle. For a few of them, the lack of fluency in speaking English and their shyness were two more factors that caused them to struggle with presentations. Students may not delve into class discussions due to similar reasons as well. "In regard to the education environment in China, a teacher- centred lecture method has been dominant in the Chinese teaching and learning culture for centuries" (Gu, 2006). (Meleis, 1982) mentioned as well that Arab students seem to be far less communicative and tend to dialogue less; this is not attributed to a paucity of ideas nor inability to debate as much as it is due to an educational socialization that has taught them that respect for authority- the teacher-should be manifested in careful listening. In our study, the Saudi student Ahmed indicated that he was less interactive in class discussion because he was not familiar with such a way of teaching and learning; the lectures in his home country used to be mostly directed by the professor, where the students only listen. In fact, it was indicated by the professors I interviewed that graduate students tend to be more quiet in the classes; they mostly do not interact or ask questions.

In some universities in other parts of the world, undergraduate students in mathematics are not required to do assignments; this hinders the improvement of their problem solving skills. As a further consequence, students struggle with solving assignments when they attend graduate school. This is especially so because mathematical problems given in graduate courses'

assignments are usually advanced. (Meleis, 1982) indicated that for many Arab students, both graduate and undergraduate, written assignments may be the first in their experience as students in western universities. They will not have grown up with the expectation of written assignments as have children educated in the American school system. Three of the interviewees mentioned that assignments were given to them when they were undergrad, but those assignments were not used to evaluate students' achievements. Saleh, the Bangladeshi interviewee, who worked as an assistant professor for twelve years in his home country, said that giving no assignments to the students or not using these assignments for assessment purposes can affect students' attendance; students may not find enough reasons to attend the classes. Supporting this point of view, (Hovell, Williams, and Semb, 1979) found that a motivation to attend class in the form of grade-related implications appears to result in higher attendance rates than when the consequences of an absence are less direct (Hans, 2006). No doubt frequent absence has a noticeable impact on students' performance; from many research studies, (Fjortoft, 2004) have concluded that there is a body of evidence that supports the positive correlation between class attendance and academic performance within college classes across disciplines.

It is better for students who aim to continue their higher education not to take long breaks in between. However, opportunities to attend graduate school or to get an acceptance for graduate programs from foreign universities are not always available. Limitations to such opportunities may be due to financial, social, or administrative issues. According to (Sedra, 2002) "a detailed graduate enrolment plan must take into account factors such as availability of qualified supervisors, availability of space and other facilities, availability of adequate funding for

students, and perhaps most importantly, the level of demand from excellent candidates”. The professors I interviewed mentioned that students who attend the graduate school after a long pause are recommended to read and review more in order to catch up with their courses. Students who want to earn a higher degree in mathematics should, at least, try to stay attached to the disciplines of mathematics by reading, searching, and practising. They have to refresh their memories frequently, so that they can be ready when the chance finally comes.

Obviously, it is not impossible for physicists or engineers to have higher degrees in mathematics as their disciplines are closely related to it; the point is that such students are maybe weak in specific areas of mathematics as their undergraduate courses have not given those areas much emphasis. It was noticeable from the interviews that Mira, who had a Bachelor’s of combined sciences- mathematics, physics and chemistry- and the other two participants from the physics department- Vladimir- and Lan needed to study extra courses either during the graduate program or before starting it in order to fill in the knowledge gaps they have in specific areas. Graduate students might be overloaded by studying additional mathematics courses during the program, as they are already have many tasks to do. It was stressful for Vladimir to do so, even though his academic standing is excellent. Lan did completed a selection of mathematics courses over a two year period before attending graduate school; she became a doubly-qualified graduate student, who is capable of dealing with financial mathematics courses.

“Assistantships have been identified as another challenge for international graduate students in their adjustment to U.S. graduate schools” (Zhou, 2010). A similar conclusion has been confirmed depending on some interviewees’ responses for this study; most of the

participants who were assigned to work as TAs mentioned that they were commonly overloaded by marking, although they believed this task to be a positive experience, and look good on their resumes. TA experiences usually added to international graduate students stress because of both the difficulties in completing their tasks and having to deal with American students and faculty complaints (Zhou, 2010). Dr. Bernard argued that graduate students should not be given more marking tasks than working in the math help center; she said that the practice of teaching and helping undergrad students is more beneficial in terms of preparing future professors. Dr. Nelson said that TA work is good, but it might be a little stressful on students who experience it for the first time, especially if they have language difficulties. However, participants who complain that TA is overload for them indicated that they cannot reduce the working hours because of financial issues; they have to pay the tuition fees which tend to increase every year. Most of those students agreed that the income they receive for their teaching assistants' duties are exactly sufficient and give them a minimum standard of living. The idea of increasing the working hours so that the income increases is rejected by most of the participants and by Dr. Harbour as well; students are already overloaded and working a few more hours will have a bad impact on their performance. The positive suggestion was either increasing the rates they receive or reducing the tuition fees.

Discussing the impact of the teaching assistants' tasks on students' academic achievement leads us to identifying financial problems. In fact, some interviewees considered their financial limitations to be the most significant, as thinking and setting economic plans for their living keeps distracting them from focusing on their studies. "Financial difficulty seemed to be the biggest problem for PRC (People's Republic of China) students because they were

sponsored by either the government or relatives with very limited income. In order to survive, these Chinese students have had to pay great attention to their financial needs rather than academic achievement” (Zhu, 2007). Yuan, the Chinese participant, discussed how he tried to minimize his expenses as much as possible in order to pay the annual tuition fee; he said that he shared the rent with about ten more tenants living together in the same house, and he used to cook instead of buying food from restaurants. Tanya from Belarus indicated that she even needs a part time job in order to earn more money especially because she has a family. Also, as the participants found cheaper accommodation located far away from their universities, they had to pay for transportation. Although this plan saves them a little amount of money, it forces them to waste more time going back and forth between home and university.

Financial issues are related as well to social problems; in order to save money, some participants left their families back home; so loneliness dominates their feelings and increases the level of absentmindedness. Lan left her four-year daughter in China, while Yuan moved to Canada without his wife. Although other participants came with their spouses and children, they indicated that they still feel homesick as they used to live within big groups of relatives and friends. (Meleis, 1982) stated that “even Arabs from small nuclear families grow up with the large network of the extended family. This extensive social network is an integral part of their everyday life and is demonstrated in many different forms”. “Homesickness becomes a big problem with international students especially when they come from a close family” (Jiménez, and Lechnitz, 2004). However, with the advancement of new technologies, international students nowadays can have different experiences dealing with homesickness and adapting to the new environment. The Internet makes it possible for international students to keep in touch

with their family and friends back home, which helps them to overcome homesickness.

However, spending a lot of time online communicating with those in their home country may also slow down the process of adapting to the new environment (Kelly, 2010).

Three participants mentioned another social issue that distracted them from their studies; they are married and have children. Taking care of their spouses and children represents another task added to their already large list of duties.

Discussing the cultural differences, (Heggins III, and Jackson, 2003) mentioned that Asian students, mainly Chinese, Japanese, and South Koreans tend to live with individuals of their own nationality, consisting of small communities; they prefer to study with and consult other Asian students rather than seeking professional sources of help, especially for emotional or psychological problems (Zhu, 2007). In our study, similar facts have been revealed; Yuan, the Chinese student, criticised that students from his country prefer to communicate with each other rather than having friends from other ethnicities. He said that these limited relationships do not help the Chinese students to adjust to the social life in Canada. Ali mentioned as well that Iranian students usually communicate with persons of their own community, even though Iranian people who live in Canada are not as close to each other as in Iran. Other participants from Asian countries like Turkey, Pakistan, and Saudi Arabia indicated also that they do have friends from different cultures, but with limitations. (Montgomery, and McDowell, 2009) argue that international students can work together and help each other to get a successful learning experience at university even if they do not have a close social and cultural contact with domestic students. However, the general phenomenon that most Chinese international students only communicate and seek help from friends from their home country does not help these

students gain learning and social experience from students of other origins (Jiao, 2006), which is one of the important benefits of studying in a different country as an international student (Zhang, and Zhou, 2010).

As indicated earlier, international students tend not to ask questions or discuss their academic problems with their professors. All faculty members I interviewed stated that they are unable to detect international graduate students' difficulties because those students do not ask for consultations or help. Both Canadian and international students do not ask questions in the classes. Some of the students I interviewed explained that they had limited access to their professors when they were undergrads, and so they used to seek for help from their classmates. This attitude has accompanied them since they were undergrads, and because of this they feel more comfortable asking for help from other people than the professors.

CONCLUSION

This study reveals several reasons behind the international graduate students' struggles with mathematics courses at a graduate level at English-speaking Canadian universities. International students may have difficulties with their English language skills, especially with regards to reading and speaking mathematics. It is suggested that such students read mathematical textbooks and other academic literature in order to improve their reading skills. The involvement in group activities and discussions with others will help improve students' English speaking skills. It was found that the lack of proficiency in mathematical jargon- specifically- hinders some international students from understanding the lectures. Attending undergraduate mathematics courses is suggested for students who received their undergraduate education in languages other than English. This suggestion is also recommended for students who have inadequate mathematical background of knowledge, which resulted from either studying insufficient number of mathematics courses, or learning courses with weak syllabus, not covering all basics.

Some international graduate students need to enhance their technology skills by attending classes or reading specialized material that will help them learn about mathematical programming and software used to solve mathematical problems. Students from departments closely related to mathematics, such as physics, computer science, and engineering, who want to continue their higher education in mathematics, need to enrich their background mathematical knowledge by taking more undergraduate mathematics courses.

It is recommended that students, who might be coming back to university to do graduate work, keep in touch with math. Students who come to a graduate school after long breaks will need to refresh their memory and retrieve what they have learned previously by reading on their own or by attending undergraduate classes as well.

As the graduate courses' requirements such as assignments, presentations, projects, take-home exams and class discussions are beneficial for graduate students in terms of leading toward deeper learning and preparing them for their future career, professors should help international students who are not familiar with such requirements. For example, giving practice problems after each lecture represents a good training for students who have never experienced solving homework assignment questions or working on take-home exams. Also, asking the graduate students to present- for no more than five minutes- explaining briefly what has been studied in the previous lecture is a great practice for those who are not familiar with giving presentations. Small group discussions in the class help international students who are used to a teacher-centered method of learning to adjust to interaction and discussion in the classes.

TA work is also effective as a way of gaining experience in teaching and marking for graduate students who are planning to work in the academic arena, but international graduate students (actually all graduate students) should not be distracted or overloaded by these tasks as they have to focus on their studies. It is suggested by a group of students who have financial problems that the income they receive for their working as TAs must be increased, or the tuition fees for international students be reduced.

Of course, other non-academic reasons such as social, financial, or cultural ones might affect international graduate students' academic performance in their mathematics courses

even in indirect ways. The social issues we investigated include homesickness and loneliness as consequences of living away from family and friends. In contrast, taking care of accompanying dependants such as spouses and children represents another problem for some international students. Differences between cultures may be problematic for international students; they may take longer to adjust to the Canadian culture. On top of previously mentioned suggestions, researchers like Montgomery and McDowell encourage international students to work together as this will help them to get a successful learning experience at university even if they do not have a close social and cultural contact with local students. This suggestion might help international students overcome cultural barriers and speed up their adaptation process. also, (Gonzalez, 2004) suggested that “most international students need orientation programs for adjusting socially and academically to their American universities environment”.

Finally, students and faculty together should co-operate to eliminate or reduce academic difficulties in mathematics courses. International graduate students should determine their weaknesses and work hard to fill in the gaps in their academic background, as they relate to the knowledge, language skills, and technological skills. Professors must lower their expectations due to students’ academic performance, English language proficiency, and technological skills. Students and departments together should co-operate to address financial, social, and cultural issues.

CLAIMS AND RECOMMENDATIONS

Some may claim that the reasons investigated in this study are broad; that these reasons apply to more than just those struggling with mathematics courses. This is true, but in this study, I explained how these particular reasons lead to the problem, discussed some specific issues such as the lack of mathematical computer programming skills, which is not required in other specialities. Also, I was more specific in mentioning that studying mathematics in English requires knowing mathematical jargon and expressions; this type of linguistic knowledge is not covered in academic English programs that teach English as a second language. Still, some factors, which are related to financial, social, and cultural issues, are not relevant only to international graduate students in mathematics; but it is important not to ignore those reasons as I aimed in my research to clarify what academic problems the graduate students might face, why they face them, and how to best overcome them.

In this study, only some reasons for international graduate students' struggles with math courses were revealed; that was because the research was solely based on my interviews. In order to draw a full picture of the problem, I need to expand my work to include more international graduate students from other countries. From my perspective, in order to achieve more comprehensive coverage of this topic, I might use a survey to determine the countries that most international graduate students come from to continue their higher education in Canada. Then I would interview more than one graduate student from each country to explore what other reasons for their problems might be. I expect that the expansion of this work will result in

a comprehensive picture that benefits Canadian universities- especially since the number of international graduate students in Canada is increasing.

I also recommend expanding this study to include Canadian graduate students, in particular those coming from outside of Ontario. Graduate school requirements differ quite a bit, and these students could experience problems and frustrations similar to those of international students.

CHAPTER 7

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APPENDIX A

Interview Questions

(for international graduate students)

A Study of International Graduate Students' Experiences with Math Courses at Graduate level in Canadian Universities.

Sarah O.Melaibari, (Master of Science candidate)

(Department of Mathematics and Statistics, McMaster University)

Information about interview questions

From the interviews I want to learn more about the following:

- What difficulties international graduate students have with math courses at graduate level,
- Why they encounter these obstacles, and
- How they plan to overcome them.

I set a semi-structured interview with open-ended questions. Because of this, I may change the wording of some of my questions. I might use other short questions either to make sure that I understand what you told me or to retrieve more information about specific points. I will ask you first to provide me with your demographic data, such as your ethnicity, gender, age, native language, degree, etc.

Here are the questions that I plan to ask you:

1. How long have you been in Canada? Are you enjoying it here?
2. What graduate level mathematics courses do you study, or have studied?
3. What do you think is the level of difficulty for each of these courses'? Are they too difficult, moderately difficult, just right or easy or too easy?
4. What do you think about the content of the courses? Is it intensive? Good?
5. What do you think about the method of assessment used to evaluate students' achievement? Are they effective? Why?
6. As an international student, how do you describe the educational system of your home country (College or university)?

7. Did you struggle with any of your courses? Did you need help? Did you seek help?
8. Why do you think these courses are difficult for you? Is that related to your level of language proficiency?
9. Is that related to unfamiliarity with the educational system? Time gap between earning your last degree and starting the current program? Anything else?
10. Do you consider yourself well-prepared for graduate school? Why, or why not?
11. Do you think you need to learn more undergraduate courses? Why?
12. What do you think the reasons for your struggles?
13. "Is there any financial issue? Social? Or cultural?"
14. How did you overcome your struggles?
15. Do your graduate courses support your thesis/ project work? If yes, please tell me how?
16. What skills you need improve to fulfill courses requirements successfully?
17. Is there something important we missed or is there anything else you think I need to know to understand what it is like for an international student to study mathematics in a graduate program in Canada?
18. Do you have any suggestions for international graduate students or for the faculty members in mathematics?

APPENDIX B

Interview Questions (for faculty members)

A Study of International Graduate Students' Experiences with Math Courses at Graduate level in Canadian Universities.

Sarah O.Melaibari, (Master of Science candidate)

(Department of Mathematics and Statistics, McMaster University)

Information about interview questions

From the interviews I want to learn more about the following:

- What difficulties international graduate students have with math courses at graduate level,
- Why they encounter these obstacles, and
- How they plan to overcome them.

I set a semi-structured interview with open-ended questions. Because of this, I may change the wording of some of my questions. I might use other short questions either to make sure that I understand what you told me or to retrieve more information about specific points. I will ask you first to provide me with your demographic data, such as your ethnicity, gender, age, native language, degree, etc.

Here are the questions that I plan to ask you:

1. What graduate level mathematics courses do you teach, or have taught?
2. What do you think is the level of difficulty for each of these courses'? Are they too difficult, moderately difficult, just right or easy or too easy?
3. What do you think about the content of the courses? Is it intensive? Good?
4. What methods of assessment you use to evaluate students' achievement? Are they effective? Why?
5. Have you taught or supervised international graduate students? How many?

6. Did any of your international students struggle with any of your courses? Do you think they need help? If they got help, did you notice any difference in their achievement?
7. Why do you think these courses are difficult for them? Is that related to their level of language proficiency? Unfamiliarity with the educational system here? Time gap between earning their last degree and starting the current program? Anything else? Please explain.
8. Do you think they need to learn more undergraduate courses? Why?
9. If you were the supervisor of some of them, do you think these courses support their thesis/ project work? If yes, please tell me how?
10. What do you think international graduate students need to adjust to the educational environment here?
11. Do you think that international graduate students are well-prepared for graduate school? Why, or why not?
12. Do you have any suggestions to improve the graduate program?
13. Is there something important we missed or is there anything else you think I need to know to understand what it is like for an international student to study mathematics in a graduate program in Canada?

APPENDIX C
Email Recruitment Script

Sarah O. Melaibari,

Masters Candidate in Mathematics

“A Study of International Graduate Students’ Experiences with Math Courses at Canadian Universities.”

Email subject line: A Study of International Graduate Students’ Experiences with Math Courses at Canadian Universities.

Dear faculty member:

I am inviting you to participate in a 60-90 minute interview that will be conducted a mutually agreed time and day, at a convenient location. As part of the Master of Science program in Mathematics at McMaster University, I am conducting a study to understand international graduate students’ experiences with mathematics courses at the graduate level. I hope to learn_ from your point of view_ about the reasons behind the difficulties encountered by international graduate students and find strategies to overcome some of them.

The interviews will be audio recorded, the data will be kept confidential, and the names of the participants will not be revealed in any form (written or oral). You are free to withdraw at any time. In some cases, a very short follow up interview might be required (about 5 minuets length). I have attached a copy of a letter of information about the study that provides details of my study, and a copy of the interview questions, hoping those attachments will provide a clear idea about this research. This study has been reviewed and approved by McMaster Research Ethics Board. If you have questions or concerns about the ethics approval process, please contact:

McMaster Research Ethics Board Secretariat

Tel# (905) 525-9140 ext. 23142

C/o Office of Research Services

E-mail: ethicsoffice@mcmaster.ca

For your convenience I have provided my contact information below. Please feel free to email or call me to learn more about this study.

I know you are busy and may not have time to participate in my study. However, I would like to thank you in advance for your time and consideration. In a week or so, a follow-up to this email will be sent to you by the department secretariat.

Sarah O. Melaibari

Masters Candidate in Mathematics

Department of Mathematics and Statistics

McMaster University,

Hamilton, ON

Cell phone: (647) 962-7505

melaibso@math.mcmaster.ca

APPENDIX D
Email Recruitment Script

Sarah O. Melaibari,

Masters Candidate in Mathematics

**“A Study of International Graduate Students’ Experiences with Math
Courses at Canadian Universities.”**

Email subject line: International Graduate Students’ Experiences with Math Courses at Canadian Universities.

Dear international graduate student:

If you had your undergraduate degree outside Canada, you are invited to participate in a 60-90 minute interview that will be conducted a mutually agreed time and day, at a convenient location. As part of the Master of Science program in Mathematics at McMaster University, I am conducting a study to understand international graduate students’ experiences with mathematics courses at the graduate level. I hope to learn_ from your point of view_ about the reasons behind the difficulties encountered by international graduate students and find strategies to overcome some of them.

The interviews will be audio recorded, the data will be kept confidential, and the names of the participants will not be revealed in any form (written or oral). You are free to withdraw at any time. In some cases, a very short follow up interview might be required (about 5 minutes length). I have attached a copy of a letter of information about the study that provides details of my study, and a copy of the interview questions, hoping those attachments will provide a clear idea about the research. This study has been reviewed and approved by McMaster Research Ethics Board. If you have questions or concerns about the ethics approval process, please contact:

McMaster Research Ethics Board Secretariat

Tel# (905) 525-9140 ext. 23142

C/o Office of Research Services

E-mail: ethicsoffice@mcmaster.ca

For your convenience I have provided my contact information below. Please feel free to email or call me to learn more about this study.

I know you are busy and may not have time to participate in my study. However, I would like to thank you in advance for your time and consideration. In a week or so, a follow-up to this email will be sent to you by the department secretariat.

Sarah O. Melaibari

Masters Candidate in Mathematics

Department of Mathematics and Statistics

McMaster University,

Hamilton, ON

Cell: (647) 962-7505

melaibso@math.mcmaster.ca

DATE: 20/10/2011

APPENDIX E
LETTER OF INFORMATION / CONSENT

A Study of International Graduate Students' Experiences with Math Courses

Investigators:

Student Investigator:

Name: Sarah O. Melaibari

Department of Mathematics and Statistics

McMaster University

Hamilton, Ontario, Canada

(647) 962-7505

E-mail: melaibso@math.mcmaster.ca

Faculty Supervisor:

Name: Dr. Miroslav Lovric

Department of Mathematics and Statistics

McMaster University

Hamilton, Ontario, Canada

(905) 525-9140 Ext. 27362

E-mail: lovric@mcmaster.ca

Purpose of the Study

In this study, which represents my Master's thesis, I seek to understand the difficulties faced by international graduate students of mathematics at English-speaking Canadian universities. I plan to determine whether this problem is related to language barriers, time gap between the last acquired degree and the current one, to educational systems to which students have been exposed in their countries of origin or to some other reasons. Interviewing a wide-ranged and varied set of international graduate students as possible is important to draw a full picture about the problem.

This study helps to improve the academic graduate programs of the department of mathematics by adjusting to students' needs and enhancing their learning outcomes. It also leads international graduate students to discover their weaknesses and prepare themselves academically to fulfill the requirements of their programs.

You are invited to take part in one of the interviews I will conduct. You are welcome to share your experience with math courses at graduate levels.

Who is invited to participate in this study?

All international graduate students who had their undergraduate degree outside Canada are welcome to take part in this study.

Procedures involved in the Research

After signing this consent form, I will suggest that we meet at a mutually convenient time in a location that will offer some privacy. I will ask you some questions related to your studies. For example, I will ask if you have any difficulties with your math courses, the reason why you encounter these obstacles, and how you overcome them. Some of my questions will focus on your last acquired degree, e.g. where did you get your last degree? I will ask you to name the differences between the educational systems of your last institution and the current one...etc.

As well, I need basic demographic/background information like your age and education. You have the right not to answer the questions you are not comfortable with. You can withdraw from the interview at any time. The interview will take between 60-90 minutes. It will be audio recorded using a device that is specifically assigned for this study. In some cases, a follow up interview might be required. In this follow up interview I will ask you either to clarify some points that I didn't understand or to add few details that help to fill up missing spaces in the whole picture of the problem. To save your time, I can email these questions to you or make a short phone call to ask you. However, It is not expected for this follow up interview to take more than few minutes (e.g. 5 minutes). You will be contacted with regards to this follow up interview if needed. All data will be treated as confidential. Your replies will be kept anonymous. I will present the results of my study in a way that does not identify any interviewee. No one, except for me will have access to the data. After finishing my thesis, I will send you a summary of the results if you indicate that you are interested to see it. Moreover, I will compensate you twenty-dollar Tim Horton's gift certificate for your participation.

Potential Harms, Risks or Discomforts:

The risks involved in participating in this study are minimal. You may feel uncomfortable with telling your own story with math courses at graduate level. You may worry about how others will react to what you say.

In this case;

You do not need to answer questions that you do not want to answer or that make you feel uncomfortable.... And you can withdraw at any time. I describe below the steps I am taking to protect your privacy.

Potential Benefits

While the research will not benefit you directly I hope that what is learned as a result of this study will help us to clarify the difficulties that international graduate students face and how they can prepare themselves better in order to succeed in graduate schools in Canada. Also, it may help to improve the academic graduate programs of the department of mathematics to fit students' needs and enhance their learning outcomes.

Payment or Reimbursement

For taking part in the interview, you will receive a twenty-dollar Tim Horton's gift certificate.

Who will know what I said or did in the study?

You are participating in this study confidentially. I will not use your name or any personal information that reveal your identity. No one but me will know that you participated in the interview.

Sometimes it is possible to decipher people's identities from the stories they tell. However, you are free not to tell what may reveal your identity. As well, I will focus in presenting the important part of the story, ignoring the details that never enrich the study and might identify you.

The recorded information/data you provide will be kept in a locked desk/cabinet in my home office that only I will have access to. Information kept on a computer will be protected by a password. Once the study has been completed, the data will be destroyed using Mathematics Department's confidential waste management procedure.

What if I change my mind about being in the study?

Your participation in this study is voluntary. If you decide to be part of the study, you can decide to stop (withdraw), at any time, even after signing the consent form or part-way through the study. If you decide to withdraw, there will be no consequences. Any data you have provided will be destroyed unless you indicate otherwise. If you do not want to answer some of the questions you do not have to, but you can still remain a part of the study. Your decision whether or not to be part of the study will not affect your relationship with the faculty members, and will not affect your access to any of the university services.

Information about the Study Results

How do I find out what was learned in this study?

I expect to have this study completed by approximately *April 30th 2012*. If you would like to receive a brief summary of the results, please let me know and I will send it to you.

Questions about the Study

If you have questions or need more information about the study itself, please contact me at:

E-mail: melaibso@math.mcmaster.ca

Cell phone: (647) 962-7505.

This study has been reviewed by the McMaster University Research Ethics Board and received ethics clearance.

If you have concerns or questions about your rights as a participant or about the way the study is conducted, please contact:

McMaster Research Ethics Secretariat

Telephone: (905) 525-9140 ext. 23142

c/o Research Office for Administrative Development and Support

E-mail: ethicsoffice@mcmaster.ca

CONSENT

I have read the information presented in the information letter about a study being conducted by Sarah O. Melaibari of McMaster University.

I have had the opportunity to ask questions about my involvement in this study and to receive additional details I requested.

I understand that if I agree to participate in this study, I may withdraw from the study at any time. I have been given a copy of this form. I agree to participate in the study.

Signature: _____

Name of Participant (Printed):

1. I agree that the interview is audio recorded.

... Yes.

... No.

2. ...Yes, I would like to receive a summary of the study's results.

Please send the summary to this email address:

Or to this mailing address:

... No, I do not want to receive a summary of the study's results.

3. I agree to be contacted about a follow-up interview, and understand that I can always decline the request.

... Yes. Please contact me at:

... No.

4. I agree to be interviewed via Skype, I understand that I can use this option if I want.

... Yes.

... No.