Predicting the At-Risk Status of Males and Students With Disabilities

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Executive Summary

This report examines the postsecondary attrition and academic performance of males (compared to females) and students with disabilities, two groups on which limited research is currently available. The research addresses four main issues: 1) differences in attrition patterns among the targeted sub-populations, 2) a comparison of the background, demographic, psychosocial and study skill variables that lead to attrition and poor first semester performance, 3) the predictive value of these variables for the targeted sub-populations in identifying students who are at risk at the time they enter college and 4) reasons given by students for leaving postsecondary study prior to completing their diplomas. The analysis included those students who commenced studies for the first time at a large non-residential English college in Quebec between 1990 and 2007. The college offers three-year career programs (26% of enrolments) and two-year programs leading to university entrance (68% of enrolments). Six percent of students are also enrolled in qualifying studies. In addition to the high school average, we compared three groups of variables 1) six background variables obtained from the students' records (Records variables), 2) nine variables obtained from the college's annual incoming student survey (ISS variables) and 3) ten psychosocial and study skill variables obtained from the Student Readiness Inventory (SRI variables) (ACT Testing Services, 2008). The following provides a summary of the findings related to each of our research questions.

Are the attrition patterns of students with and without disabilities similar?

Although we anticipated that the attrition patterns for students with and without disabilities would be similar, this proved not to be the case. For both the three-year career programs and two-year pre-university programs, attrition rates were lower for students with disabilities in the early semesters. For pre-university programs the average rate of dropout between semester 1 and 3 over the period studied was 15.5% for students with disabilities vs. 25.7% for students without disabilities. However, the attrition rate for students with disabilities was higher between semesters 4 and 10 (23.3% for students with disabilities vs. 14.9% for students without disabilities). This pattern was also true in three year career programs. However, the graduation rates, as measured at the commencement of the 10^{th} semester, were similar for both groups. The

percentage of students who were still enrolled in the 10th semester, with the potential to graduate at some future time, was somewhat higher for students with disabilities. The pattern of lower dropout in the early semesters, and higher dropout in later semesters held for both males and females with disabilities. Males dropped out at higher rates than females for both students with and without disabilities, with the attrition rate for males approximately 10% - 12% higher by the tenth semester.

Is the attrition rate of males the same as that of females, when corrected for high school average?

Our hypothesis that males with high school averages below 80% drop out at higher rates than females with comparable averages, but that the gap narrows for averages above 80% was supported. Males entered the college with lower high school averages than females. Consequently, it was possible that the reason males dropped out at higher rates was solely a reflection of the difference in high school entry grades. The attrition rate of male students with high school averages below 80% was 8% - 11% above that of females with high school averages in the same range. At an average above 80% the gap narrowed, and the attrition rate of males was only 2% higher. This held true regardless of disability. In other words, a large part of the problem of high rates of attrition in the male population was related to those males entering with high school averages in the lower range.

Is the high school average the strongest predictor of both attrition and poor academic performance, but a better predictor of academic performance?

Our hypothesis that the high school average would be the best predictor of both dropout and academic performance, but a better predictor of academic performance, was supported. The models showed that, of the variables we tested, the high school average was the best predictor of first semester grades and dropout by both the 3rd and 10th semester. The addition of background, demographic and psychosocial and study skill variables to the high school average did not improve the ability of the models we tested to predict academic performance, except marginally, and to a greater extent for males. The one exception was for females with disabilities, where the high school grade was not the best predictor of 3rd semester attrition, although it was the best predictor of 10th semester attrition. The metrics we used to compare the regression models

showed that the high school average was better able to discriminate between students achieving either high or low grades in the first semester, than between students who dropped or did not dropout by either the 3rd or 10th semester. This was determined by comparing the areas under the ROC curves. Areas were rated 'fair' at best for the attrition ROC curves, but 'good' for the academic performance curves. The precision of the academic performance models was also higher. However, in absence of the high school grade, all three groupings of variables we tested were able to give better than chance prediction for both attrition and first semester performance with few exceptions.

Are the factors associated with male attrition similar to those of females?

Our hypothesis was that the factors that are associated with males dropping out will be similar to those of females, but their relative importance will differ.

Students Without Disabilities

When all 15 background and demographic variables were tested in our 3rd semester attrition models, high school average and age entered the logistic regression for both females and males, and were the strongest predictors of attrition for both groups. Older students commencing studies for the first time were more likely to drop out. In addition, motivation and language were two variables that entered the model for females but not males. Other variables that were significant in the 3rd semester attrition model for males, but not females, were median family income, paid employment, level of studies, English placement level and country of birth.

The level of studies to which the student aspired was significant for males but not females. The difference in the attrition rate for males who said that they hoped to achieve a Bachelor's degree or Diploma was 10.8% higher than those who claimed they aspired to a Masters or PhD. The difference for females (3.2%) was not significant. The only grouping where we found male attrition rates to be lower than those of females, was in the group of males who aspired to a PhD.

There was a significantly higher attrition rate for both males and females who worked over 15 hours per week in paid employment (Females: 9% higher; Males: 13% higher), although the variable did not enter the logistic regression for females. Another variable with a large

difference in the attrition rate was program choice. The attrition rate was 10.4% higher for females who were not in their first choice program, a variable that was not significant for males.

There does, therefore, seem to be some differences in the factors contributing to male and female attrition, although the strongest predictor for both groups was the high school average. In addition, the predictive value of the variables was higher for males than for females. Generally, male models tended to have higher sensitivity and precision over the cutoff range.
The effect sizes (measured by the Nagelkerke R^2 which has a theoretical range between 0 - 1) were also larger for males compared to females, indicating a stronger relationship between the variables we tested and the attrition rate for males. However, the largest effect sizes obtained for the attrition models we tested were .219 for males and .178 for females, indicating that although variables were significant, the strength of the association was not strong.

Students With Disabilities

Due to sample size constraints, we were only able to compare survey variables for students with disabilities using chi square tests. The common variables for males and females with disabilities with significant differences in attrition were high school average and age. Although out-of-class study time was not significant for either males or females, it was significant when both groups were combined. There was a 15.9% differences in attrition rate between those who did and those who did not spend more than 12 hours on out-of-class study, a differential that was higher than for the age (9.9%) and high school average (8.6%) variables.

We were only able to do more limited modeling of students with disabilities using variables obtained from the student's records, due to sample size constraints associated with variables collected from surveys. In the pre-model tests of 10^{th} semester attrition, several variables were significant for males (high school average, age, country of birth and English placement level), but only high school average entered the regression model. For females, only the high school average was significant on the pre-model tests, and this variable entered the model along with language. As was the case for students without disabilities, the precision, sensitivity and areas under the ROC curves of the male models were higher than for female models, and the strength of the association between the variables we tested was higher for males. Overall, however, the

ability of the models we tested to discriminate between dropout/retention was lower for students with disabilities compared to their nondisabled peers

Summary

There was sufficient evidence to conclude that although the variables that are related to male and female attrition did overlap, with the strongest variables for both groups being age and high school average, there were some notable differences. Thus our hypothesis was only partially supported. The relative importance of the variables in predicting attrition was higher for males compared to females.

Do factors that predict attrition in pre-university programs also predict attrition in career programs?

We tested eight records variables in this analysis. In the model pre-test all variables were significant with the exception of country of birth for both diploma types, and median income which was not significant for career programs. High school average, age and sex were the variables with the heaviest weights for both groups. The variables entering the logistic regression model were high school average, age, language and sex for both career and pre-university programs. Median family income entered the pre-university model but not the careers model. For the most part, the variables that contributed to dropout in career programs also contributed to dropout in pre-university programs. Median family income however, was more of a factor in pre-university programs. We did not test the survey variables in these models.

Do the factors that are predictive of poor academic performance in the first semester differ from those that predict attrition?

Our hypothesis was that the factors that are predictive of poor academic performance will differ from those that predict attrition. We were only able to include the Records and ISS variables for students without disabilities in this analysis due to sample size constraints related to students with disabilities. Only third semester attrition is compared, as there was no ISS survey data relating to tenth semester attrition.

Students Without Disabilities

We found that the high school average was the strongest predictor of first semester grades, and for males, it was the only variable entering the first semester performance model. However, for the third semester attrition model, high school average entered the model along with age, level of studies, paid employment, median family income and English placement level. Although high school average was the strongest predictor of both attrition and academic performance, there were more variables that were significant in the male attrition models than in the performance models. For females, high school average entered the performance model as did language and median family income. However, for the third semester attrition model high school average, language, age and motivation entered the model. Consequently, the variables that were significant for the attrition model overlapped to some extent as high school average and language entered both models. However, age and motivation were unique to the attrition model.

Students With Disabilities

Although we were unable to model third semester attrition using the survey variables for students with disabilities due to sample size constraints, we did compare the differences in attrition rates by level of the independent variables using chi square tests, and differences in first semester grades using independent sample t tests. For males, high school average, age and mother's country of birth showed significant differences in third semester attrition by level of the independent variable. Variables showing differences in first semester grades were high school average, age, mother's country of birth as well as level of studies, study time in last year and time anticipated on out-of-class study at college. Three of the six variables related to third semester grades were also related to third semester attrition. For females, high school average, age, median family income and English placement level showed significant differences in 3rd semester attrition by level of the independent variables. Variables showing differences in first semester grades by level of variable were high school average, and English placement level. Two of the four variables related to attrition were also related to first semester grades.

Summary

Our hypothesis was only partially supported. Although there were some variables that were related to both third semester attrition and first semester performance, there were more variables that were significant in the attrition models. Age, which figured prominently in the models of attrition, did not enter the models of academic performance. Unlike the attrition models, the variables we tested were equally able to discriminate between high and low first semester CRC scores for both males and females and students with and without disabilities. There were no differences in the strength of the relationship between first semester performance and the variables we tested among groups.

Psychosocial and Study Skill Variables (ACT Student Readiness Inventory)

Students with disabilities scored significantly lower than their nondisabled peers on six of the ten SRI psychosocial and study skill scales, as did males. The largest difference between students with and without disabilities was on the Academic Self-Confidence scale followed by the Social Connection Scale. The largest difference between males and females (without disabilities) was on the Academic Discipline scale followed by the Communications Skills scale. There were no differences in scale scores between males and females with disabilities, although the numbers of those responding were low, making it difficult to show significance. Although the ten SRI psychosocial and study skill scale variables were better able than the Records variables to discriminate between high and low first semester grades, neither grouping of variables enhanced the discrimination achieved by the high school average alone. We were unable to test the SRI variables in attrition models because the number of those dropping out by the third semester were too low at the time of writing, and the sampling adequacy criteria was not met.

Reasons For Leaving College – Do They Differ Among Sub-populations?

Our hypotheses 1) that the most important reasons for leaving given by students with disabilities would be similar to those of students without disabilities, and not related to their disabilities, and 2) that the reasons for leaving of males and females with and without disabilities would mirror each other were not supported. A significantly larger proportion of students with disabilities (40%) than without disabilities (1%) indicated that they left Dawson due to disability/personal health issues. This was also the most frequent reason reported by females with disabilities. The

most important reasons for leaving given by females without disabilities were to attend university, and career direction uncertainty/change. For males without disabilities the most frequent reasons were career direction uncertainty/change and because they did not like the program they were in.

Our hypothesis that students who leave in the first and second semester of their programs will report different reasons for leaving their college studies compared than those who leave in the third or later semesters was supported. Students leaving in their first year were more likely to say they left due to career direction uncertainty/change, or they did not like the program they were in. The most frequent response category for students who left later in their studies was low motivation and other factors inside the college. There was also some support for our hypothesis that the reasons for leaving for males and females would be similar, as three of the top five reasons for leaving were the same for both groups. However, attendance at university and disability/personal health issues did not rank in the top five for males. Attended a different college and the shooting incident did not rank in the top five for females.

Predicting Attrition and Academic Performance

Many of the variables we used in this study have been reported in the literature to be related to student departure, and many of them were statistically significant in the models we tested. However, when added to the model with the high school grade, they did little to enhance the ability of the model to discriminate between dropout/retention, or low/high first semester academic performance over what could be achieved by the high school grade alone.

By examining the ROC curves we could improve the precision of the models we tested. But the precision of 3rd semester models was low. To a certain extent this was related to the fact that so few students dropped out by the third semester relative to the number who were retained, that the effect of the false positives was high. For a model to be precise when there is a large imbalance in occurrences of the binary classifier, the specificity would have to be very high. Precision and effect sizes improved when we modeled attrition to the 10th semester, and using the coefficients from the 10th semester models to predict attrition on a new sample may be a better option. By the tenth semester the impact of the variables on the students' departure decisions will have had time

to manifest. However, this has disadvantages as changes that occur that could influence the model coefficients would not be detected until much later.

Profiles of Males and Females With Disabilities – Recommendations

As a result of this study and our previous work we are beginning to build profiles of males and females with and without disabilities. Based on our findings, recommendations targeted to the needs of these sub-populations are provided.

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Table of Contents

List of Tables

Part l

Part ll

List of Figures

Part l

Part ll

List of Appendices

Introduction

Theoretical Framework

Research in developing a theoretical framework for understanding and predicting student departure dates back to the 1970's. Empirical work that has been undertaken has largely been based on Tinto' Student Integration Model (Tinto,1993), Bean's (1982) Student Attrition Model and Astin's (1975) Theory of Involvement. In Tinto's model, pre-entry characteristics, initial goals and commitments, academic and social integration, and emerging goals and commitments resulting from experience within the institution are seen as key factors that can help identify students at risk of abandoning their studies. Developing congruency between the student and institution was seen as especially crucial during the first year. One of the early criticisms leveled at the Tinto model is that it failed to include a series of external variables. This was addressed in his later work (Tinto, 1993). Working from a different theoretical base, Bean (1982) proposed a model that included external variables such as behavioral indicators, particularly student contact with faculty (measure of student interaction) and time spent away from campus (measure of lack of involvement). Since the 1980s attempts to integrate the models found them to be complementary (e.g., Cabrera, Nora & Castaneda,1993).

Metz's (2006) review of traditional measures of retention indicates that achievement and ability, family background (e.g., level of parental education), and student demographics (e.g., full vs part-time, age, sex, ethnicity, financial need) are all important influences on retention. Both Metz' (2006) and Hudy's (2007) literature reviews also show that personality and psychosocial adjustment, social support, perceived institutional climate, and academic self-efficacy all have empirical support. Student engagement was also found to be important (Kuh, 2007, 2003), and has led to the development of the National Survey of Student Engagement (NSSE).

Psychological models of motivation have included expectancy-value formulations and models combining motivation and skills constructs (e.g., Pintrich, 2000). Eccles and Wigfield (2002) link academic persistence to individuals' expectancy and task-value related beliefs. They define expectations in terms of self-efficacy beliefs and task-values in terms of intrinsic and extrinsic goals, relative costs (obstacles, effort), and attainment value (importance of doing well). Their

model contains numerous linked constructs, including variables such as perceptions, attitudes and expectations, which are key in Ajzen's (1991, 2002) Theory of Planned Behavior as well.

Grayson and Grayson (2003) in a review of the literature on student persistence in post-secondary education, found that although theoretical approaches are proving useful in sensitizing researchers to relevant issues, the ability to successfully isolate specific factors has proved to be difficult. Concerns relating to the Tinto model, and models influenced by it, are summarized by Grayson and Grayson as: (a) attrition explained by these models has been variable (ranging between 11% - 46%); (b) factors that are important vary from institution to institution; (c) failure to delineate the different categories of attrition (e.g., voluntary vs. non-voluntary drop-out); (d) low sample sizes; and (e) the failure to consider the student's point of view. Although these models and theories are useful in identifying and defining key variables leading to attrition, as well as giving insight into the types of interventions that may prove useful, they lack the high level of prediction that are needed by administrative staff that would allow students who are most at-risk to be identified as early as possible.

In an attempt to integrate the findings from the psychological and educational literatures Robbins et al. (2004) conducted a meta-analysis of over 100 studies in an attempt to integrate both psychosocial and skills based constructs. The meta-analysis revealed nine psychosocial constructs that were predictive of college success. Of these, three demonstrated validity in predicting academic performance, and six were able to improve prediction of college persistence at an early stage i.e. before the student enters the college.

It is not surprising that results of the many studies that have been undertaken over the last 30 years have been so variable. Clearly the students' 'departure decision' is made within the context of a complex web of interactions among a vast array of variables related to sociological background, economic conditions, academic preparedness, institutional characteristics, degree of social engagement and psychological processes. Individual students, and even groups of students, are acted upon and respond to this complex of factors in different ways. For example, for older part-time students, drop-out is more significantly affected by external environmental influences than by the classroom and school environment (Glynn, et al., 2003). Existing models

may show such variability in predicting retention because factors that are related to dropout and academic performance may vary among student sub-populations.

Student dropout has important consequences for both society (Canadian Council on Learning, 2006; Statistics Canada, 2003) and the students themselves, as dropping out can result in diminished access to employment and earning potential (Fassinger, 2008; Metz, 2006). Dropouts also have a major impact on the finances of colleges and universities (Baum & Payea, 2004; Pascarella & Terenzini, 2005; Summ, Fogg & Harrington, 2003). Consequently, researchers continue to try to understand and predict persistence in higher education (Barr-Telford, Cartwright, Prasil & Shimmons, 2003; Tinto, 1993; Robbins, et al., 2004; Wintre & Bowers, 2007).

Despite the decline in male enrolments in higher education experienced in most OECD countries since the 1970's (Frenette & Zeman, 2007; Summ, Fogg & Harrington, 2003; Ministère de l'éducation du Québec, 2001), and the increasing numbers of students with disabilities enrolled in post-secondary education in both Canada and the US (Tremblay & Le May, 2005; Snyder & Dillow, 2007), little work has been done to determine the factors that contribute to attrition in these two groups, and the specific supports required to deter them from leaving prior to completing their diplomas. The growth in enrollments of students with disabilities poses new challenges for colleges. The decline in males entering post-secondary education, and the number failing to complete their credential once enrolled, are also of concern to many policy makers trying to balance future labor market demands in the skilled occupations.

This study examines how the early departure of students from college is related to high school grades, background and demographic variables as well as the ten psychosocial constructs identified by Robbins et al (2004). It explores the ability of these variables to predict student dropout prior to students entering their programs. Only students studying full-time at a Quebec college for the first time are included in our sample (Cohort A). We examine the differential impact of these variables in relation to the dropout rates and academic performance of males and females, and students with and without disabilities. By examining the patterns of attrition, the variables that are related to dropout, and the reasons these two groups of students give for

leaving college, we begin to build an understanding of the similarities and differences between these sub-populations, and make recommendations related to the specific support needs of these two groups.

Characteristics of the College

Dawson College, at which this study was undertaken, is the largest English language college (cegep or collège d'enseignement général et professionnel) in Quebec and is located in downtown Montreal. It is a non-residential college and each year it enrolls approximately 7500 full-time students in two and three-year diploma programs (Diplôme d'études collégiales (DEC)). It also offers transition sessions through which students may qualify for entry into programs. Two year programs are designed to provide the necessary qualifications for entry into university, while three year career programs provide for direct entry into the labor force in skilled occupations. In addition, the College has approximately 1500 students enrolled in its evening, continuing education division. Students are enrolled in independent studies, attestations (AEC's) or are undertaking DEC studies in the evening.

The college offers pre-university studies in the social sciences, liberal arts, science, and both creative and fine arts. Its career sector offers studies in engineering, applied health sciences, photography, theatre, design, chemical technology, business, social service, recreation leadership training and computer science. Its campus is ethnically and linguistically diverse, with of 20% of students originating from over 80 countries outside of Canada. Thirty nine percent of students have a mother tongue other than English (French: 18%; Other Language: 21%).

Organization of the Paper

The study is divided into three parts. Part I tracks the attrition patterns of males and females with and without disabilities over a 10 semester (5 year) period. It also examines male and female dropout for students with equivalent high school averages.

The following hypotheses are examined in Part I:

1. The attrition patterns of males and females will differ - with a larger percentage of males dropping out at all stages of their programs - between semester 1 and semester 2, semester 2 and semester 3 etc.
2. The attrition patterns of students with and without disabilities will be similar, however, the pattern for males and females with disabilities will mirror those of males and females without disabilities.
3. The attrition rate of males with high school averages below 80% will be higher than that of females with high school averages below 80%, but the rates for male and females with high school averages above 80% will be similar.

Part II of the study uses variables obtained from the students' records and from the college's Incoming Student Survey to compare the characteristics of males and females with and without disabilities, and to compare and contrast the predictive values of models of attrition using the variables in different combinations. It was designed to test the following hypotheses:

1. The high school average will be the strongest predictor of both attrition and poor academic performance, but will be a better predictor of academic performance than of attrition.
2. The factors that are associated with males dropping out will be similar to those of females, but their relative importance will differ.
3 Factors that predict attrition in pre-university programs will also predict attrition in career programs.
4. The factors that are predictive of poor academic performance will differ from those that predict attrition.

Part III examines the reasons for leaving given by the different groups of students. It tests the following hypotheses:

1. The Reasons for Leaving of males and females will be similar, but their relative importance will differ.
2. The most important Reasons for Leaving given by students with disabilities will be

similar to those of students without disabilities – and not related to their disabilities.

3. The Reasons for Leaving of males and females with disabilities will mirror those of males and females without disabilities.
4. Students who leave in the first and second semester of their programs will report different reasons for leaving their college studies than those who leave in the later semesters.

Part IV of the report presents the summary, discussion, recommendations and limitations of the study.

Part I
Patterns of Student Attrition in Two Year and Three Year DEC Programs

1 Background

Part I of the study was designed to test the following hypotheses:

1. The attrition patterns of males and females will differ - with a larger percentage of males dropping out at all stages of their programs - between semester 1 and semester 2, semester 2 and semester 3 etc.
2. The attrition patterns of students with and without disabilities will be the similar, however, the pattern for males and females with disabilities will mirror those of males and females without disabilities.
3. The attrition rate of males with high school averages below 80% will be higher than that of females with high school averages below 80%, but the rates for male and females with high school averages above 80% will be similar.

1.1 Methodology

The total sample used in this study consisted of a master list obtained from the academic records system. Only students commencing full-time study in a college in Quebec for the first time (Cohort A students), and who started a DEC program or transition session in the autumn semesters between 1990 and 2006 were included. This resulted in a total sample of N = 40682. This was the master list on which tracking to the 3rd and 10th semester was based. All analyses in this study are based on subsets of the master list unless otherwise stated. This part of the analysis is based on the thirteen cohorts who commenced between 1990 - 2002. This resulted in a sample size of N = 31,255. By using these cohorts, all students in the sample would have had the opportunity to reach the 10th semester at the time of the present evaluation. The breakdown by sex, diploma type and disability status is shown in Table 1.1.

Table 1.1 Master List - Enrolments by Sex, Disability and Sector of Enrolment.

	Diploma Type	Sex	N 1990 - 2002	N 1990 - 2006
No Disabilities	2 Year Programs	F	12952	17175
		M	10277	12968
		Total	23229	30143
	3 Year Programs	F	2581	3385
		M	2329	3018
		Total	4910	6403
	Transition Session	F	1216	1580
		M	1143	1460
		Total	2359	3040
With Disabilities	2 Year Programs	F	317	456
		M	288	428
		Total	605	884
	3 Year Programs	F	53	73
		M	39	59
		Total	92	132
	Transition Session	F	33	41
		M	27	39
		Total	60	80
All Students	2 Year Programs	F	13269	17631
		M	10565	13396
		Total	23834	31027
	3 Year Programs	F	2634	3458
		M	2368	3077
		Total	5002	6535
	Transition Session	F	1249	1621
		M	1170	1499
		Total	2419	3120
Grand Total			31255	40682

Using software developed at the college, these students were tracked from their commencing session to the 10th semester of study (i.e., the second semester of the fifth year of the program). Students with disabilities in the sample were those who had registered with the campus based Services for Students with Disabilities.

In each of the nine semesters following the commencing semester, students were flagged as either graduated, still enrolled or no longer enrolled. Students who left their program in one semester, but returned in a later semester to continue their studies, were accounted for in the calculation of attrition rates. Consequently, when the number of students who return from an earlier period of absence exceeds the number who leave, the attrition rate will be negative. The attrition rate at Time X was calculated as follows:

Rate of Attrition (%) at Time X = Number of students in a commencing cohort in Semester A who left without graduating at Time X / Total number of commencing students in Semester A

1.2 Attrition Patterns Two Year Programs

The attrition patterns of females (N = 13269) were compared to those of males (N = 10565) and those of students without disabilities (N = 23229) were compared to those of students with disabilities (N = 605). The total number of students in the sample for students in two year programs was N = 23834.

Males and Females – Two Year Programs

Males dropped out of their programs at higher rates than females, especially in the early semesters (Figure 1.1). By the beginning of the third semester, 29.4% of males had left their program without graduating, compared to 22.2% of females (Table 1.2). By the beginning of the tenth semester 47.2% of males had left their programs without graduating compared to 35.2% of females. In the tenth semester, between 3% and 5% of students were still enrolled with the potential to complete their programs. Although the largest percentage of both male and female students dropped out between the first and third semester, the rate of attrition in subsequent semesters was not insignificant, especially for males (Males = 17.8 %; Females = 13.0%).

Figure 1.1- Attrition Rate Between Semesters for Male and Female Cohort A Students in Two-Year Pre-university Programs.

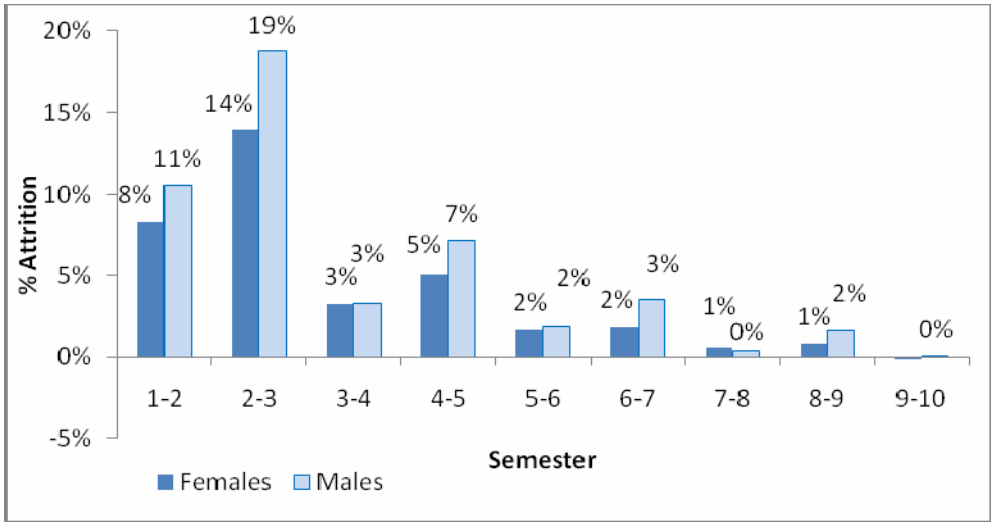


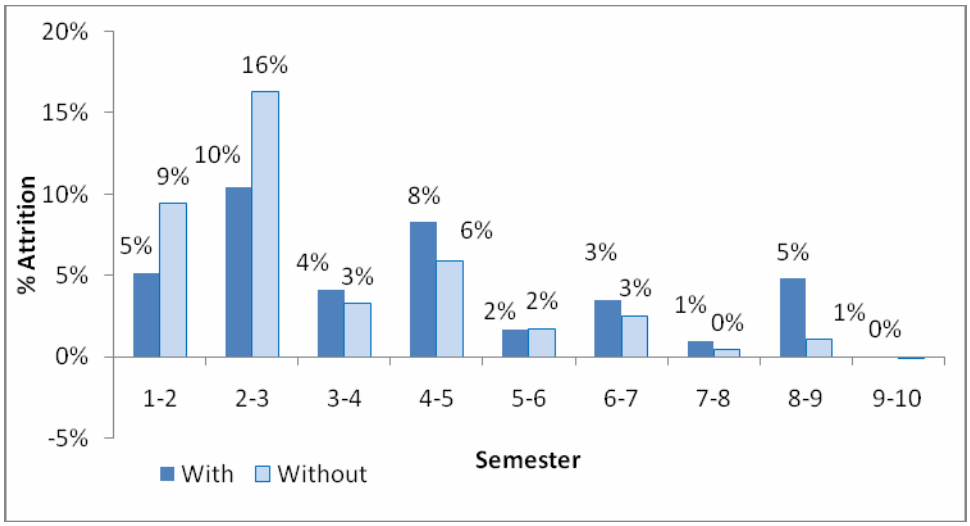
Table 1.2- Enrolment Status of Cohort A Students With and Without Disabilities in Two Year Pre-University Programs at the Beginning of the Tenth Semester.

	N	Sem1 - 3 (a)	Sem 4 - 10 (b)	Attrition (c=b+a)	Graduated (d)	Still Enrolled (e)	*f = c+d+e*
With Disabilities							
Females	317	14.2%	20.2%	34.4%	60.9%	4.7%	*100%*
Males	288	17.0%	26.7%	43.8%	50.3%	5.9%	*100%*
Total	605	15.5%	23.3%	38.8%	55.9%	5.3%	*100%*
Without Disabilities							
Females	12952	22.4%	12.8%	35.2%	61.5%	3.2%	*100%*
Males	10277	29.7%	17.6%	47.3%	48.1%	4.6%	*100%*
Total	23229	25.7%	14.9%	40.6%	55.6%	3.8%	*100%*
All Students							
Females	13269	22.2%	13.0%	35.2%	61.5%	3.3%	*100%*
Males	10565	29.4%	17.8%	47.2%	48.2%	4.6%	*100%*
Total	23834	25.4%	15.1%	40.5%	55.6%	3.9%	*100%*

Students With Disabilities – Two Year Programs

The pattern of attrition for students with disabilities differed from that of their non-disabled peers over the period studied. At the beginning of the third semester, 25.7% of non-disabled students had dropped out, while only 15.5% of students with disabilities had left without completing their diploma (Table 1.2). Between the first and third semester students with disabilities left their studies at a lower rate than those without disabilities. However, in the following semesters the attrition rate for students with disabilities was higher (Figure 1.2). Between the third and tenth semester, 23.3% of students with disabilities left compared to 14.9% of students without disabilities (Table 1.2). A larger percentage of students with disabilities dropped out after the third semester (23.3%) than between the first and third semester (15.5%), contrary to the expected pattern. The pattern of lower dropout in the early semesters, and higher dropout in later semesters held for both males and females with disabilities. However, as was the case for students without disabilities, males dropped out at higher rates than females in both periods, with the attrition rate for males 9% - 10% higher by the tenth semester.

Figure 1.2 - Attrition Rate Between Semesters Comparing Students With and Without Disabilities in Two-Year Pre-university Programs (Cohort A).



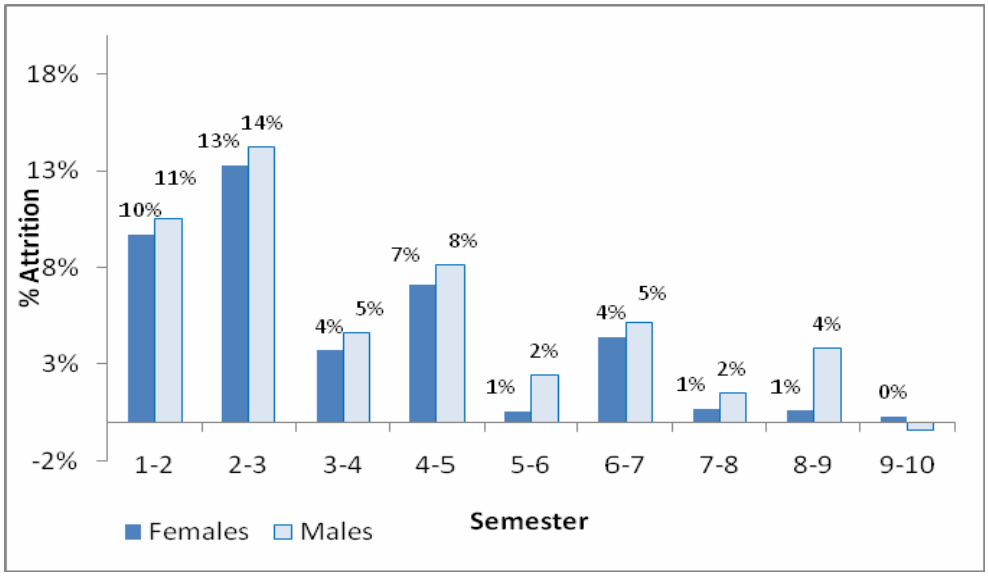
1.3 Attrition Patterns in Three Year Career Programs

As was the case for two year programs, students were tracked from their commencing session to the tenth semester, or their fifth year in the program. The attrition patterns of females (N = 2634) and males (N = 2368) and students with (N= 92) and without disabilities (N = 4910) were compared. The total sample size was N = 5002

Males and Females – Three Year Programs

As was the case with pre-university programs, attrition rates were higher for males in nearly every semester (Figure 1.3). By the beginning of the tenth semester the attrition rate for males (50.0%) was approximately 9% - 10% higher than that of females (40.5%) (Table 1.3). A higher proportion of males (8.2%) than females (4.8%) were still enrolled in the tenth semester with the potential to complete their programs, and this was true for both students with and without disabilities.

Figure 1.3 Attrition Rate Between Semesters for Male and Female Cohort A Students in Three-Year Technical Programs.



Students With and Without Disabilities – Three Year Programs

As was the case with pre-university programs, it can be seen in Table 1.3 that attrition rates were lower for students with disabilities in the early semesters (8.7% for students with disabilities vs 24.1% for students without disabilities). The attrition rate for students with disabilities was higher between semesters 4 and 10 (33.7% for students with disabilities vs 21.0% for students without disabilities). The graduation rates, as measured at the commencement of the 10th semester, were identical (48.7%). The percentage of students who were still enrolled in the 10th semester, with the potential to graduate at some future time, was somewhat higher for students with disabilities (9.8% vs 6.3%). The percentage for males with disabilities was particularly high (12.8%).

Table 1.3 Enrolment Status of Cohort A Students With and Without Disabilities in Three Year Career Programs at the Beginning of the Tenth Semester.

Group	N	Sem1- 3 (a)	Sem 4 - 10 (b)	Attrition (c=b+a)	Graduated (d)	Still enrolled (e)	*f = c+d+e*
With Disabilities							
Females	53	7.5%	35.8%	43.4%	49.1%	7.5%	*100%*
Males	39	10.3%	30.8%	41.1%	46.2%	12.8%	*100%*
Total	92	8.7%	33.7%	42.4%	48.7%	9.8%	*100%*
Without Disabilities							
Females	2581	23.3%	17.1%	40.4%	54.9%	4.7%	*100%*
Males	2329	24.9%	25.2%	50.2%	41.8%	8.0%	*100%*
Total	4910	24.1%	21.0%	45.1%	48.7%	6.3%	*100%*
All Students							
Females	2634	23.0%	17.5%	40.5%	54.7%	4.8%	*100%*
Males	2368	24.7%	25.3%	50.0%	41.8%	8.2%	*100%*
Total	5002	23.8%	21.2%	45.0%	48.6%	6.4%	*100%*

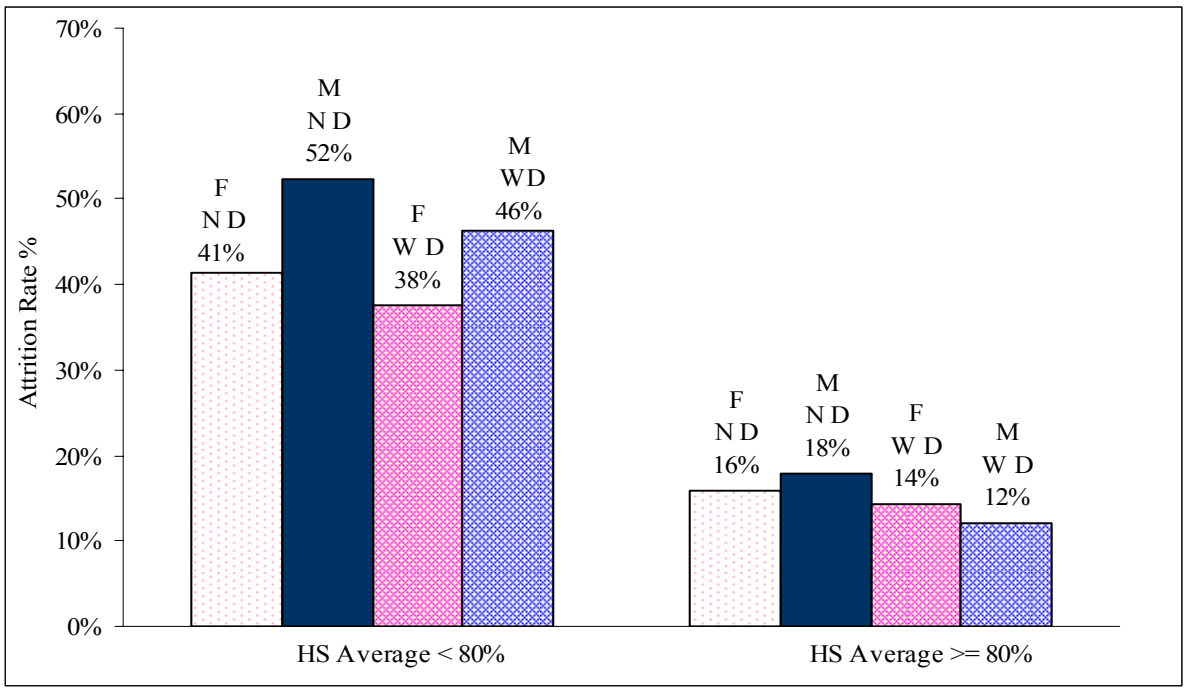
As was the case for the two year programs, the largest drop rate for students with disabilities was not between the first and second year (where the drop rate was only 8.7%) but after the second year when over 37.7% of students dropped out. In the case of males without disabilities roughly half of the dropout occurred between year 1 and 2 and the other half by semester 10.

1.4 Rate of Attrition and High School Grade

The attrition rates for males and females for high school averages above and below 80% are shown in Figure 1.4. The graph shows that the attrition rate (probability of drop out) for males is higher than that of females for high school averages in the equivalent range. There was a difference of 11% for high school averages below 80%, but the gap closes to 2% at the higher end. The pattern for students with disabilities was similar, with a narrower gap in attrition for males and females with averages below 80% (8%), and narrowing to 2% for averages above 80%. Appendix 22 provides a more detailed breakdown of the rate of attrition for males and

females at matched high school averages. Females had high school averages that were higher than those of males, and this was true of both females with and without disabilities (Without disabilities: Females = 76.0%; Males = 73.5%; With Disabilities: Females = 74.3%; Males = 72.0%). In addition the high school averages for males and females without disabilities was higher than for their non-disabled peers.

Figure 1.4 Female (F) and Male (M) Attrition Rate by Semester 10 by High School (HS) Average - Students With and Without Disabilities *(WD = With Disabilities; ND = Without Disabilities).*



Summary

The data did not support our hypothesis that the attrition patterns for students with and without disabilities would be similar. Although by the 10th semester the attrition rates were comparable, students with disabilities experienced lower dropout rates in the earlier semesters compared to students without disabilities, in both two and three year programs. In fact, a higher proportion of the dropout for students with disabilities occurred after the third semester.

There was support for our hypothesis that males with high school averages below 80% would drop out at higher rates than females with comparable averages. The difference in the attrition rate between male and female students with high school averages below 80% was between 8% -

11%. At an average above 80% the gap narrows, and the attrition rate of males was only 2% higher than that of females.

Part II

Modeling Attrition and Academic Performance

2 Background

In this section the high school average, seven variables obtained from the students records' (referred to as Records variables), nine variables obtained from the Incoming Students Survey (ISS) (referred to as ISS variables) and ten scale variables obtained from the Student Readiness Inventory (referred to as SRI variables) (ACT, 2008) were used to compare the four targeted sub-populations. Variables were tested in logistic regression models of first semester academic achievement as well as attrition to the third and tenth semesters to isolate which were the strongest predictors.

This section of the report addresses the following research hypotheses:

1. The high school average will be the strongest predictor of both attrition and poor academic performance, but will be a better predictor of academic performance than of attrition.
2. The factors that are associated with males dropping out will be similar to those of females, but their relative importance will differ.
3. Factors that predict attrition in pre-university programs will also predict attrition in career programs.
4. The factors that are predictive of poor academic performance in the first semester will differ from those that predict attrition.

2.1 Sample Characteristics, Methods of Analysis and Sampling Adequacy

2.1.1 Sample Characteristics

The master list consisting of all students who commenced college for the first time between 1990 and 2006 was obtained from the college's academic records system. Extracted with the student number, were their high school average, English placement test level, country of birth, language (or mother tongue), diploma type, age and postal code (from which the median family income was derived using census data obtained from Statistics Canada). Sex and disability status were also extracted in order to compare the models we developed based on sex and disability. In some

analyses these two variables were also entered as test variables into the models. Information obtained from surveys as well as academic performance data were joined to the data set using the student number as the key. The sample for this part of the study consisted of 40682 students who were first-time, full-time students at a Quebec college. The breakdown by sex, sector of enrolment and age is shown in Table 2.1.

Table 2.1 Master Sample – Break Down by Sex, Sector of Enrolment and Average Age.

	N	Mean Age	SD
Females Without Disabilities			
Pre-University	17175	17.4	1.8
Careers	3385	19.3	5.2
Transition Session	1580	18.0	3.3
Total	22140	17.8	2.8
Females With Disabilities			
Pre-University	456	17.8	3.4
Careers	73	18.2	2.5
Transition Session	41	21.6	10.8*
Total	570	17.8	2.5
Males Without Disabilities			
Pre-University	12968	17.6	1.8
Careers	3018	18.8	4.0
Transition Session	1460	17.9	3.3
Total	17446	18.1	4.4
Males With Disabilities			
Pre-University	428	17.8	1.7
Careers	59	18.7	3.4
Transition Session	39	18.0	2.9
Total	526	17.9	2.1
All Students			
Pre-University	31027	17.5	1.8
Careers	6535	19.0	4.6
Transition Session	3120	18.0	3.5
Total	40682	17.8	2.7

**7 students in this group were aged over 30, with one individual aged 63 and another 54, accounting for the high standard deviation in the group.*

This list was linked to the college's tracking software using the student identification number in order to ascertain the students' enrollment status at the beginning of each semester, from the third to the tenth semester. At the beginning of each semester a student was flagged as '1' if they were not enrolled, and had not graduated, or 0 if they were still enrolled or had graduated. Semester 3 was the beginning of the second year, and semester 10 was the second semester of the fifth year of a program. The different analyses undertaken in Part II of the study used subsets of this master data set unless otherwise stated. The analyses were carried out comparing four groups, males and females with and without disabilities.

2.1.2 Records Variables

Records variables are collected as part of the student's dossier by the college upon admission. Therefore, the analyses using this data source avoids the non-response and coverage errors introduced when data is sourced from surveys. It was, therefore, possible to model the attrition rates to the beginning of the tenth semester for a large sample of Cohort A (i.e., new to study at a Quebec college) students who commenced their programs full-time between 1990 and 2002 (N = 31,255). It was also possible to model attrition rates to the third semester for a large sample of students based on these variables (N = 40,682). In addition to the Records variables listed earlier, the high school average was also obtained from the academic records, but was treated separately from the Records variables in our analyses. Details concerning these variables are provided in Table 2.4 of the report.

2.1.3 Incoming Student Survey Variables (ISS)

The Incoming Student Survey was administered by the College to students starting their study at a college in Quebec for the first time. It was administered prior to the start of study in the autumn semesters between 2004 - 2006. The survey collects information on a number of student interests and behaviors prior to entry into the college, as well as additional demographic variables that are not available from the students' records.

Nine variables that were of interest in this study were obtained from the ISS databases held in the Office of Institutional Research. The data from these variables was linked to the master list obtained from the students' records using the student number as the key. These variables were: mother's place of birth, father's place of birth, hours of paid employment, anticipated time of

study at college, time spent on study in last year of study, level of study aspired to, level of motivation, whether students were in their first choice program. Level of parental education was used to derive the 'first generation college student' variable. If neither parent was reported by the student as having completed college level studies or higher, the student was classified as a first generation college student. More details concerning the ISS variables are provided in Table 2.4 of the report.

These ISS variables as well as the Records variables were used to develop third semester attrition, as well as first semester academic achievement models. However, because of the limited period over which the ISS survey was administered, we were unable to model tenth semester attrition for this set of variables, and the modeling of tenth semester attrition was limited to the Records variables. The sample size for the ISS analysis was also limited by the response rate to the survey. Over the three years that it was administered, 4456 students replied to the survey; of these 150 (3.4%) were students registered with Services for Students With Disabilities. This represented an average response rate for the three years of 62.9%.

2.1.4 Student Readiness Inventory (SRI)

The SRI was developed by Le and his colleagues (2005), and is based on constructs identified in the meta-analysis undertaken by Robbins et al.(2004) that were shown to have incremental validity over high school grades and standardized achievement tests in predicting college persistence and grade point average. The instrument consists of 10 scales (Academic discipline, Academic self-confidence, Commitment to college, Communication skills, Steadiness, General determination, Goal striving, Social activity, Social connection, and Study skills) and each scale is made up of 10-12 items using a 6-point Likert-scaling (Strongly Disagree to Strongly Agree). Psychometric analyses have shown that the instrument is internally consistent, with Cronbach's alpha on the ten scales ranging from 0.80 - 0.87 (Robbins, et al., 2004; Le, 2005). The survey provides an integrated framework of theoretical concepts that have emerged from the fields of psychology and education.

In addition, the following institution-specific questions were included: the number of hours the student intended to work during the semester, level of motivation, whether the student had a disability, including the nature of the impairment, and level of parental education. The level of

parental education was used to determine whether the student was a first generation college student.

In the Fall semester of 2007, the Student Readiness Inventory (SRI) was mailed to approximately 2800 incoming students in their first year of study at a college in Quebec. This instrument was used in place of the Incoming Students Survey, normally sent each year as part of the College's ongoing collection of data concerning its students for the purposes outreach and providing support. The first mail-out took place during the first week of class in late August. Students were given two weeks to respond. A follow up mail-out, with a reminder letter was then sent to students who failed to reply. The returned surveys were sent to ACT Testing Services for scoring. There were 434 surveys returned, representing a response rate of 15.5%.

2.1.5 Method of Analysis and Sampling Adequacy

Binary logistic regression was used to help develop models to evaluate 1) the factors (independent variables) that contributed to students leaving their studies prior to the third or tenth semester without graduating, 2) the predictive value of the variables and 3) whether the variables differed among the targeted sub-populations. In a similar manner, the technique was also used to ascertain factors that contributed to a lower level of academic performance in the first semester of study. SPSS version 12 was used for the statistical analyses undertaken in this study.

The binary variable used in the modeling of attrition was 'dropped out' (attrition = 1) as opposed to 'did not drop out' (retention = 0). This was assessed at the beginning of the third and tenth semester. For the academic achievement variable we converted the CRC score (a weighted grade average with a theoretical range between 1 – 50) into a binary variable. Although some information is lost in doing this, it allowed us to compare both the attrition and academic performance models using the same metrics. We used a CRC of 25 as the cutoff. The binary form of the variable was CRC < 25 (coded as 1) vs. CRC >= 25 (coded as 0).

Prior to modeling, we did an initial analysis of differences in the rates of attrition by level of the independent variables in order to determine the extent of these differences (e.g., rate of attrition between the two levels of the age variable: those aged 18 and over, and those under 18 years of

age). We used chi square tests for the attrition rate comparisons, and MANOVA or ANOVA, as appropriate, for comparisons of academic performance.

2.1.6 Binary Logistic Regression Assumptions and Sampling Adequacy

In order for logistic regression to be reliable, a number of assumptions need to be met (cf. Menard, 1995; Peduzzi, Concato, & Kemper, 1996; Savage & Smith, 2008). The dependent variable must be dichotomous. One of the dependent variables used in this study was dropout vs retention. Dropout (attrition) was the variable of interest and was assigned the value of 1. Retention/attrition is a binary variable commonly used in educational studies. The second dependent variable was academic achievement. The CRC score was converted to a binary variable for reasons described in Section 2.1.5. As relatively low academic achievement was the variable of interest, if the CRC score fell below 25, it was coded as 1. If it fell at or above 25 it was coded as 0.

Menard (1995) suggested that correlations of .8 between independent variables should be a cause of concern as excessive multicollinearity results in high standard errors of the coefficients generated by the model. Correlations among the independent variables in this study indicated that the highest correlation between any two variables was 0.4.

For goodness of fit measures, like chi-square, cell frequencies formed by the categorical independent variables need to be >= 1 and no more than 20% of cells should have a frequency of < 5, as the presence of sparsely populated or empty cells may cause the logistic model to become unstable (Howell, 2002). In order to ensure that these assumptions were met, variables were cross-tabulated in SPSS. As one of the objectives of our research was to compare attrition models for males and females with and without disabilities, cross-tabulations were done for the four groups. No variable violated the rule for students without disabilities. For students with disabilities, 0 counts were found for the variables ‘Program Choice’, ‘Motivation’, ‘First Generation College Student’ and ‘Paid Employment’. In addition ‘Study Time Last Year’ also had a 0 value for males with disabilities. In addition, some ISS survey variables resulted in low frequencies of students who dropped out. Consequently, the survey variables in question were omitted from the logistic regression modeling for this group. Language, diploma type, country of birth were omitted for the same reason.

Austin, Yaffke, and Hinkle (1992) suggested 30 cases per independent variable. For dichotomous variables, Peduzzi et al. (1996) recommend that the smaller of the classes of the dependent variable have at least 10 events per parameter in the model. In our study this was either the number of students who dropped out, or the number with CRC scores above or below 25, depending on the which was lowest. As we were comparing outcomes of males and females with and without disabilities, the sampling adequacy criteria needed to be met for the four groups. We evaluated the high school average and six variables derived from the students' records in our modeling to the 10^{th} semester, and consequently there needed to be at least 70 students who dropped out by the tenth semester for each group. The sample sizes for this part of the analysis were Females Without Disabilities: N = 16749, Males Without Disabilities: N = 13749, Females With Disabilities: N = 403, Males With Disabilities: N = 354. All four groups met the overall sampling size criteria.

For modeling to the third semester, we initially evaluated the high school average and six variables derived from the students' records. In this case 70 students needed to have dropped out by the third semester. The sample sizes were (Females Without Disabilities: N = 22140, Males Without Disabilities: N =17446, Females With Disabilities: N = 570 and Males With Disabilities: N = 526. Some levels of the independent variables violated the sampling adequacy criteria for students with disabilities, and these variables are highlighted when this occurred.

We also encountered problems when we incorporated the nine variables derived from the Incoming Student Survey into the analysis. As survey data were collected only from 2004 - 2006, we could only model third semester attrition, and had sample sizes that were constrained by the survey response rates. In addition fewer students drop out between semester one and three than semester one and ten. This was especially true for students with disabilities, who had lower dropout rates for this period than their non-disabled peers. The total N values were: Females Without Disabilities: N = 2612, Males Without Disabilities: N =1694, Females With Disabilities: N = 67, Males With Disabilities: N = 83. Because of the small sample sizes for students with disabilities, we did not incorporate the ISS variables into the models of attrition for this group of students. We did however compare drop rates by level of variable using either chi square or analysis of variance, as was appropriate.

With respect to the academic performance criteria, we initially modeled the seven Records variables, and therefore, the smaller of the class of the dependent variable required 70 occurrences. Some levels of the variables may have violated the criteria and when this happened this was pointed out in the analysis. As was the case for attrition, sampling adequacy problems arose for some of the Records variables and variables derived from the ISS survey for students with disabilities. Consequently, the ISS and SRI variables were omitted from the academic performance models for this group of students. We did, however, evaluate the differences in academic performance by level of the independent variables. When we included variables that that did not strictly meet the adequacy criteria, this was noted in the analyses.

2.1.7 Metrics Used to Compare the Performance of Logistic Regression Models

The classification matrices that were generated by the logistic regression were used to compare the sensitivity, specificity, accuracy and precision of the models we developed. The Nagelkerke R^2, also generated by the software, was used to compare the strength of association between the independent and dependent variables. The Nagelkerke R^2, often described as a pseudo R^2, has a theoretical range between 0 - 1, with higher values indicating a stronger association. It serves as a measure of effect size.

For each model tested, the probabilities (cutoffs), sensitivity, specificity and false positive rates (1- specificity) generated by the logistic regression were saved. The Receiver Operator Characteristics (ROC) curves for each of the models were plotted and compared on the basis of the areas under the curves (AUC's). We also calculated the specificity and precision of the models we tested and plotted them against their associated probabilities (or cutoffs). This allowed us to visually compare how the models we developed for the sub-populations of interest differed on these characteristics, and allowed us to compare and optimize the predictive value of the models.

2.1.8 Receiver Operator Characteristics Curves (ROC Curve)

An ROC curve is a representation of the performance of a classifying variable, and is a convenient visual way to summarize the accuracy of predictions. It has been commonly used in the medical sciences to determine the accuracy of diagnostic tests (Zweig & Campbell, 1993). In

this study, ROC curves were used to summarize the accuracy of models that predicted student dropout by either the third or tenth semester, as well as how well students performed academically in their first semester. The terminology and definitions related to the ROC curve, as used in this study, are shown in Table 2.2 and are derived from those used by Fawcett (2004).

The ROC curve plots sensitivity against the false positive rate (1 – specificity) at each cutoff for the classifier being tested. In this study the binary classifying variable used for attrition modeling was: dropout = 1, retention = 0. Definitions are as follows.

Sensitivity. The sensitivity of the model was defined as the percentage of students who dropped out who were correctly classified in the dropout category.

Specificity. Specificity was defined as the percentage of retained students who were correctly classified in the retained category.

False positives. The false positive rate was the proportion of students classified correctly as retained subtracted from one (1 - specificity).

Precision (PPV). The positive predictive value (PPV), or precision, was defined as the probability that the student dropped out, given that they were assigned to the dropout group by the model (i.e., the percentage of students assigned by the model to the dropout group who actually dropped out).

For the academic achievement model, the binary variable was: CRC below 25 = 1; CRC at or above 25 = 0. In this context, the sensitivity of the model was defined as the percentage of students who fell below the cutoff of 25, who were correctly classified as falling below the cutoff. The specificity was defined as the percentage of students who achieved a CRC at or above 25, who were correctly classified as achieving a CRC score at or above 25.

Table 2.2 Receiver Operator Characteristic Curves – Terminology and Definitions.

Metric	Metric equivalent	Code	Definition	Calculation
True Positive		TP	Of the students who dropped out, the number who were correctly classified as dropping out	
True Negative		TN	Of the students who were retained, the number who were correctly classified as retained	
False Positive		FP	Of the students who were retained the number who were classified as dropping out	
False Negative		FN	Of the students who dropped out, the number who were classified as retained	
True Positive Rate	Sensitivity	TPR	% of total number of students who dropped out who were classified correctly	TPR = TP/Total Actual Dropout
True Negative Rate	Specificity	TNR	% of total number of students retained who were classified correctly	TNR = TN/Total Retained
False Positive Rate (Type 1 error)	1 – Specificity	FPR	% of students that are retained but who are classified as dropping out	FPR = 1 – TNR (or Specificity)
False Negative Rate (Type ll Error)	1 – Sensitivity	FNR	% of students who dropped out who are classified as retained	FNR = 1 – TPR (or Sensitivity)
Positive Predictive Value	Precision	PPV	% of model predicted attrition that is correctly classified	PPV = TP/(TP+FP)
Negative Predictive Value		NPV	% of model predicted retention that is correctly classified	NPV = TN/(TN + FN)
Accuracy		ACC	% of total sample correctly classified	(TP+TN)/N

The false positive rate was 1 – specificity. The positive predictive value (PPV) or precision, was defined as the probability that the student received a CRC below 25, given that they were assigned to that group by the model.

The ROC curve plots the sensitivities generated by the regression model on the Y axis against the false positive rate (1-specificity) on the X axis. The steeper the ROC curve (i.e., the closer the ROC line is to the upper left corner of the plot), the higher the overall accuracy of the test (Hanley & McNeil, 1982; Zweig & Campbell, 1993).

2.1.9 Comparing Areas Under the ROC Curves (AUC's)

In order to compare whether the models used to predict attrition were significantly different from each other, we compared the areas under the ROC curves (AUC's) using the methodology described by Hanley and McNeil (1982, 1983). The area under the curve is, in fact, a probability. For example, an AUC = .8 for an ROC curve derived from the attrition model probabilities means that a randomly chosen student from the the students who dropped out will have a higher probability of dropping out assigned by the model than one chosen randomly from students who were retained 80% of the time (Zweig & Campbell, 1993).

For areas derived from two tests applied to a different set of cases, the method involves calculating the standard error (SE) of the difference between the two areas being compared (A1 and A2) using the following formula:

$$\text{SE (A1 - A2)} = \sqrt{\text{SE}^2(\text{A1}) + \text{SE}^2(\text{A2})}$$

For two tests applied to the same set of cases the following formula was used:

$$\text{SE (A1 - A2)} = \sqrt{SE^2(A1) + SE^2(A2) - 2r * SE(A1) * SE(A2)}$$

The 'r' represents the correlation introduced between the two areas because both curves are based on the same sample of students. A failure to account for 'r' results in a lower z value than would otherwise be the case, therefore, reducing the chance of detecting a difference. The 'r' value was obtained as outlined in Hanley and McNeal (1983). The z values are calculated as shown below, using the standard error of the differences in areas determined by either of the two equations shown above.

$$z = (\text{A1} - \text{A2}) / \text{SE (A1} - \text{A2)}$$

We chose the critical value of $z = 1.96$ and $p < .05$ to determine whether the comparative areas under the ROC curves differed from each other. The rough guide provided by Tape (2008) was used to evaluate the AUC's derived from the models we generated as 'fail', '.poor', 'fair', 'good' or 'excellent' (Table 2.3).

Table 2.3 Guidelines for Assessing the Accuracy of ROC Curves.

Area Under ROC	Evaluate AUC
.90 – 1.0	Excellent
.80 - .90	Good
.70 - .80	Fair
.60 - .70	Poor
.50 - .60	Fail

2.2 Records Variables, High School Averages and Persistence at College

For this part of the analysis we examined the short term (to the 3rd semester) and longer term (to the 10th semester) retention/attrition of students based on high school average, sex, disability, and six variables that were readily obtainable from historical records held in the academic systems of the college (Table 2.4). The cohort that commenced studies in 2002 was the last to have reached the 10th semester at the time the study was commenced. The cohort that commenced in 2006 was the last cohort for which 3rd semester attrition rates were available. This allowed us to compare the factors related to attrition, as well as the accuracy and precision of our models for the different tracking periods.

Students were considered to have 'dropped out' if they had not graduated, and were not enrolled at the beginning of either the 3rd or 10th semester following the year of commencement of studies. Conversely, students were considered to be 'retained' if they had graduated, or were still enrolled, at the beginning of the 3rd or 10th semester.

2.2.1 Tenth Semester Attrition by Level of Variable

The attrition rates were examined by the beginning of the tenth semester for the variables shown in Table 2.4. The rates of attrition by level of independent variable were calculated and are shown in Appendix 1.

Table 2.4 Records Variables Used in Modeling Attrition.

Variable	**Variable type**	**Levels**	**Code**
Age	Categorical	Under 17 17 18 Over 18	Age
	Categorical	0: Over 17 1: 17 and under	
Sex	Categorical	0: Male; 1: Female;	Sex
Country of Birth	Categorical	0: Other Country; 1: Canada;	COB
Disability	Categorical	0: No Disabilities 1: With Disabilities	Disab
*English placement Level	Categorical	*0: Levels 1 – 3 1: Level 4	EngPlace01
Language	Categorical	1: French; 2: English; 3: Other	Lang
Diploma Type	Categorical	1: Pre-University; 2: Technical; 3: Transition sessions	DipType
High School Average	Continuous	Continuous 1: Under 60 2: 61 - 70	HS Average
	Categorical	3: 71 - 80 4: 81 - 90 5: 91 – 100	HS Average Grp
	Categorical	0: Under 75 1: >=75	HS01
Median Family Income (PC)	Continuous		MFI_CD
Based on Census District	Categorical	1: $10,000 - $20,000 2: $21,000 - $30,000 3: $31,000 - $40,000 4: $41,000 - $50,000 5: $51,000 - $60,000 6: $61,000 - $70,000 7: $71,000 - $80,000 8: $81,000 - $90,000 9: $91,000 - $100,000 10: .$100,000	Income_Level
Based on Census District		0: <=$60000 1: $60,000	MedianFamInc01

**See Appendix 21 for a descriptions of English placement Levels 1 - 4.*

The groups with the highest attrition rates were those entering with high school averages below 70%, those commencing college for the first time at age 18 or over, those whose English placement level was 0 or 1 (i.e., low level of English skills), those originating from postal codes where the median family income was under $30,000 per annum and those enrolled in transition sessions (Table 2.5).

Table 2.5 Table High Risk Groups Shown From Highest to Lowest Probability of Dropping Out by the Tenth Semester - All Students. *(The overall average dropout rate by the 10th semester was 38% - 42%. Sample size ranged between N = 24556 and N = 31255, depending on the variable).*

Group	**Probability of Dropout by the 10th Semester**
High School Average < 60%	77%
*English Placement Level = 0	63%
High School Average >= 60% & <70%	62%
Age 18 or over as Cohort A	60%
*English Placement Level = 1	54%
Median Family Income <=$20,000 per year (derived from postal code)	52%
Enrolled in Transition Sessions	51%
Males	49%
Median Family Income $20,000 – $30000 per year (derived from postal code)	49%
Born Outside of Canada	46%

** See Appendix 21 for descriptions of English Placement Levels 1 – 4.*

Students with the lowest high school averages, who were aged 18 or over when starting college for the first time, and who had the lowest English placement level had attrition rates of over 60%. Students who had the second lowest English placement level, who were enrolled in transition sessions and who originated from postal codes where the median family income was

below $20,000 per annum had attrition rates by the 10th semester of between 50% - 60%. Of the groups remaining, those with attrition rates above the overall average were males (49%), those originating from postal codes where the median family income was between $20,000 and $30,000 per year, those born outside of Canada (46%) and those whose mother tongue was French (46%). Table 2.5 ranks the variables from those with the highest to those with the lowest probability of dropping out, without graduating, by the 10th semester. Of the nine variables listed in Table 2.4, the only variable that did not show a significant difference in attrition by level was the disability variable. The rate of attrition by the 10th semester was 39.9% for students with disabilities, compared to 42.1% for their non-disabled peers. The average attrition rate for the comparisons ranged between 38% and 42% depending on the groups being compared.

2.2.2 Modeling Tenth Semester Attrition Using Records Variables

We used the high school average and the eight Records variables shown in Table 2.4 to determine the extent to which they helped predict attrition by the tenth semester for males and females with and without disabilities. It should be noted that not all 31255 records were included in each analysis, as not all records had a complete set of variables. When all nine variables were used, the number of records was reduced to 22244. This sample of students had an attrition rate of 38.3% compared to 42.0% for the whole sample. The baseline attrition rate, therefore, varied between 38% - 42%, depending on the analysis.

Robustness of the Binary Logistic Regression Technique

In the initial analysis we investigated the robustness of the logistic regression technique for this type of analysis using all students in the sample. The variables shown in Table 2.4 were entered into a binary regression model using three entry methods: 1) Enter (enters all variables simultaneously); 2) Forward LR and 3) Backward LR. If the significance level of the Wald statistic is small (< .05), then the parameter is judged useful to the model. The cutoff used to run the models was 0.40. This approximates the attrition rate to the tenth semester for the sample used. A cutoff of 0.40 means that all students given a probability of 0.4 or higher by the model were assigned to the group that dropped out by the tenth semester, and those with a probability of less than 0.40 were assigned to the group that was retained (i.e., students were either still enrolled or had graduated). All three methods of entry resulted in all variables having a significant Wald statistic with the exception of country of birth, thus confirming the robustness

of the modeling technique. The output for the 'Enter' method is shown in Table 2.6 and the Forward LR method in Table 2.7. The Wald statistics, model coefficients and probabilities can be found in Appendix 2 for the 'Enter' method. When the model was validated using a random selection of 70% of the cases, country of birth and disability were not entered into the model. The percentage of students who dropped out who were correctly classified fell between 66% - 69% (Table 2.6).

If a group of students with a probability of 0.40 or higher were targeted for intervention, it can be anticipated that only 57.6% of them were correctly assessed by the model as being at risk of dropping out. For example, Table 2.6 shows that the model assigned a probability of dropout of 0.40 or higher to 9810 students.

Table 2.6 Attrition by the Tenth Semester, Showing Sensitivity, Specificity and Precision of the Model for All *Students (for High School average and 8 records variables ; Using 'Enter' Method; Cutoff = 0.40; N = 22,444*)**.**

	Predicted	Selected		Unselected (Validate)		
Actual	Retained	Dropped Out	% Correct	Retained	Dropped Out	% Correct
Retained	9695	#4160	**70.0%	na	na	na
Dropped Out	2939	##5650	*65.7%	na	na	na
Total	12634	9810	68.4%	na	na	na
PPV (Precision)			57.6%			
	Retained	Dropped Out	Total	Retained	Dropped Out	% Correct
Retained	6586	2972	**68.9%	3014	1283	**70.1%
Dropped Out	2056	3982	*65.9%	835	1716	* 67.3%
Total	8642	6954	67.8%	3849	2999	69.1%
PPV (Precision)			57.3%		57.2%	

*Sensitivity of model; **Specificity of model; #False Positives; ##True Positives.

Table 2.7 Classification Accuracy - Eight Records Variables and High School Average *(Using 'Forward LR' – Cutoff was 0.40; N = 22,444).*

	Selected			Unselected (Validate)		
Actual	Predicted Retained	Dropped out	% Correct	Retained	Dropped Out	% Correct

Retained	6590	2968	68.9%	3016	1281	70.2%
Dropout	2048	3990	66.1%	837	1714	67.2%
Total	8638	6958	67.8%	3853	2995	69.1%
PPV (Precision)		57.3%			57.2%	

N.B. Age, High School Average and Income were entered as continuous variables

Of these 5650 were correctly classified as dropping out (TP or true positives), and 4160 were classified as dropping out, although they were in fact retained (FP or false positives). The PPV (positive predictive value) of the model is, therefore, TP/(TP+FP) = (5650/(5650 + 4160)) = 57.6%. Thus in a new group of incoming students, once the probabilities have been calculated from the model coefficients, selecting a sample from all students with a model assigned probability of .40 or higher (the cutoff) would result in a sample where 57.6% of the students would be expected to drop out. As the actual probability of dropout is (2939+5650)/(9810+12634) = 38.3%, this represents better result than that achieved by randomly selecting students

In practical terms, a precision of 58% means that if 100 students were randomly selected for intervention from all students with a model assigned probability of greater than 0.40, 58 of the students targeted are likely to drop out, and 42 of the students targeted are likely be retained, regardless of any intervention. Even though 58% does represent an improvement over randomly selecting students, the cost of the intervention is high, as 42 students in 100 would have received interventions that would not have been necessary (although they may have benefited nonetheless).

However, the precision can be improved by raising the cutoff. If a sample is chosen from all students with a cutoff set at 0.9 or higher, the false positive rate is only 0.2%. Although only 1.2 percent of the dropouts are correctly classified, in this particular scenario, with a large sample size, this represents 102 students. Sometimes a low false positive rate can be more desirable than a high sensitivity. The probability of correctly targeting an at-risk student rises to 77% (102/133) i.e., the PPV rises from 58% to 77% Table (2.8). However, there is a practical limit to this, as at very high cutoffs, there may be very few students and the precision curve breaks down. Even if the precision curve does not break down, there may be fewer students in the sample than desired.

Table 2.8 Targeting the Highest Risk Students Using Binary Logistic Regression *(Cutoff 0.9, 'Enter' Method).*

	Predicted		
Actual	Retained	Dropout	% Correct
Retained	13824	*31	99.8%
Dropout	8487	**102	1.2%
Total	22311	133	62.0%
PPV (Precision)		76.7%	

**FP- False Positives; **TP = True Positives.*

2.2.3 Comparing High School Average and Records Variables as Predictors of Attrition

In this section we compare the performance of three models of attrition using the high school average alone, the eight Records variables (without the high school average), and the combined variables. The models tested are listed below:

Model 1: High School Average (High School Average Only)
Model 2: 8 Records Variables (Excludes High School Average)
Model 3: 8 Records Variables and High School Average (All 9 variables)

Since the high school average had the strongest weight when all nine variables were entered into the model, the high school average was tested as the sole predictor (Model 1). This model was then compared to Model 2 (eight Records variables only) and Model 3 (eight Records variables and high school average). The three logistic regression models were run (using the Enter method and a cutoff of .40). The models were compared on the following metrics: area under the ROC curve, sensitivity, specificity, accuracy, precision, false positive rate and the Nagelkerke R^2.

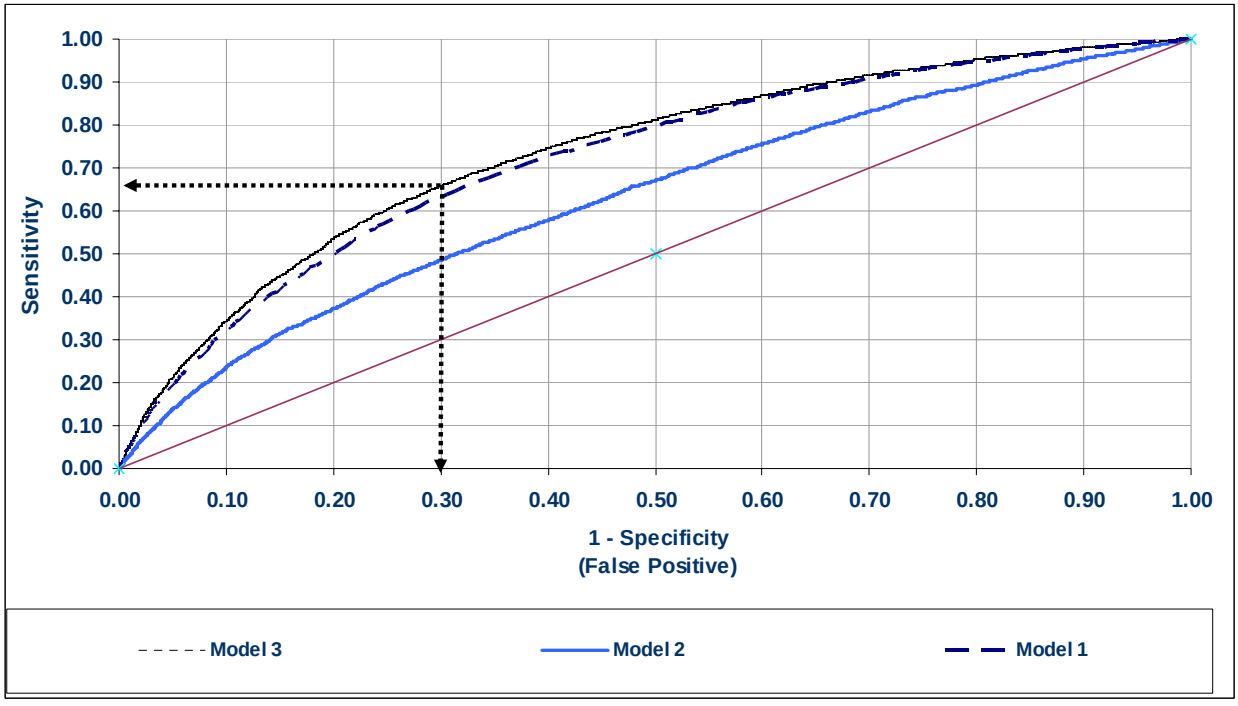
Attrition to the 10th Semester - Model Characteristics

The ROC curve plots the sensitivity against one minus the specificity (false positive rate) at different cutoffs (probabilities) which are not shown on the ROC plot. For the models of 10th semester attrition, the sensitivity was the percentage of students who dropped out by the 10th semester who were correctly classified as dropping out by the model. The specificity was the proportion of students who were in fact retained, who had a model assigned probability below

the cutoff of 0.40 (i.e., the percentage of retained students who were correctly classified as retained). One minus the specificity was the false positive rate (proportion of students who were in fact retained, but had a model assigned probability above the cutoff of .40, and were classified as dropping out). The precision was the proportion of students predicted as dropping out by the model who were correctly classified.

The most accurate model will have a high sensitivity and a low false positive rate. Visually this can be seen from the ROC curves comparing the three models (Figure 2.1). The further the line is from the diagonal (i.e., the steeper the curve), the greater the area under the curve and the better the model fit. The ideal curve occurs when X = 0 and Y = 1, (i.e., all students are classified correctly as dropping out, and all students are correctly classified as retained, that is, there are no false positives. When the area under the curve differs significantly from .5 (at $p < .05$) then the model is better than guessing.

Figure 2.1. Comparison of ROC Curves for Model 1 (High School Average), Model 2 (8 Records Variables) and Model 3 (8 Records Variables & High School Average) *(Attrition by the tenth semester).*



Based on the distance from the reference line, all three models were better than guessing, with the areas under the curves significantly > .5 and with p < .001 (Table 2.9).

In our example, the sensitivity at our chosen cutoff of 0.4 was 65.7%, and the false positive rate was 100% - 70.0% (1 - Specificity) = 30.0% (Table 2.6). This can also be seen from the ROC plot for Model 3 shown in Figure 2.1. There were statistically significant differences in AUC's between Models 2 & 1 (z = 19.57, p < .01), and Models 2 and 3 (z = 21.74, p < .01). However, there was very little difference in areas under the ROC curves between Model 1 and Model 3, although the small difference of .01 was statistically significant (z = 2.57, p = .01). The areas under the ROC curves for Model 1 (.726) and Model 3 (.736) were rated as fair (Table 2.9). Model 2 was inferior to the other two models, and the area under its ROC curve (.636) was rated as poor.

Table 2.9 Comparisons of the Areas Under the ROC Curves for Models of Attrition to the 10th Semester – All Students *('Enter' Method and Cutoff = 0.40 for 10th semester; 0 .16 for 3rd semester).*

Model	N	Area	Std. Error	Sig	Lower Bound	Upper Bound	AUC Assess-ment
Model 1 (HS Average)	24633	0.726	0.003	.000	0.720	0.733	Fair
Model 2 (8 Records Variables)	25990	0.636	0.004	.000	0.629	0.643	Poor
Model 3 (8 Records Variables & HS Average)	22444	0.736	0.003	.000	0.729	0.742	Fair

High school average and seven of the eight Records variables entered Model 3 (Country of Birth was not significant). High school average and six of the Records variables entered Model 2 (Country of Birth and Disability were not significant). However, despite the fact that the majority of the eight Records variables tested were significant, adding the eight Records variables to the High School Average did not improve the sensitivity, specificity or precision of the model to any great extent over that achieved by the high school average alone. The model using High School Average alone had the greatest sensitivity (68.3%). There was a slight improvement in the precision (57.1% to 57.6%) when all variables were used (Table 2.10). Thus, the High School Average alone was able to predict nearly as well as the all variable model, and requires less effort and fewer resources to implement.

Table 2.10 Comparison of Model Characteristics for Attrition to the 10th Semester (*Using cutoff = 0.40 for Semester 10; Using Enter Method - Period 1990 – 2002).*

Model	N	Nagel - kerke R^2	Classified Sensitivity	Specificity	False Positive Rate	Accuracy	PPV (Precision)	AUC	Rate AUC
Semester 1 – 10 (Cut point = .40)									
Model 1 High School Average	24633	.190	68.3%	66.0%	34.0%	66.9%	57.1%	.726	Fair
Model 2 (8 Records Variables)	25990	.065	54.7%	64.7%	36.3%	60.8%	50.4%	.636	Poor
Model 3 (8 Records Variables & High School Average)	22444	.203	65.6%	70.0%	30.0%	68.3%	57.6%	.736	Fair

2.2.4 Records Variables - Comparing Male and Female 10th Semester Attrition

When the rates of attrition for males and females were compared by variable, the rates for males were substantially higher than those of females for all the Records variables examined. These differences are shown in Table 2.11.

Table 2.11 Comparison of Male and Female 10th Semester Attrition Rates by Variable.

Variable	Probability of Dropout by the 10th Semester	Females	Males
High School Average < 60	76.9%	71.8%	80.9%
Age 18 + as Cohort A	59.9%	54.7%	64.8%
English Placement Level 0	63.0%	60.8%	65.4%
High School Average >=60 & <70	62.3%	56.4%	67.1%
English placement Level 1	54.3%	51.2%	57.6%
Enrolled in Transition Session	51.0%	45.4%	57.0%
Median Family Income <30,000 per year (derived from postal code)	49.2%	44.9%	54.3%
Language (French)	46.0%	41.5%	52.7%
Language (English)	41.7%	36.7%	47.6%
Language (Other than English/French)	41.0%	34.4%	48.5%
Born Outside of Canada	46.3%	41.5%	51.6%
Overall Attrition Rate	**42.0%**	**36.7%**	**48.5%**

In order to determine whether the Records variables that contributed to dropout varied by sex, logistic regression models were run for both males and females using the variables shown in Table 2.4, with the exception of sex, which was used as a selection variable. Model outputs were compared by sex for:

Model 1: High School Average (High School Average Only)

Model 2: 7 Records Variables (Records Variables - Excludes High School Average)

Model 3: 7 Records Variables and High School Average

When the scores from the pre-model test (Roa's efficiency score statistic) were examined, six of the variables were significant for both males and females. The Country of Birth and Disability status were not significant for either sex. High School average and Age had the highest scores for both sexes, and the remaining 4 variables ranked in the same order on the score statistic (Appendix 3). The variables were then entered into a logistic regression model, and the outcomes for males and females compared. The results are summarized in Table 2.12. English Placement Level was significant for females but not males, and Disability was significant for males but not females. The remainder of the variables contributed to the model for both sexes, with the exception of Country of Birth. The High School Average had the heaviest weight for both groups. Details of the Wald statistics, model coefficients and probabilities can be found in Appendix 4.

Table 2.12 Significant Variables in the Logistic Regression Model of Attrition (to the 10th Semester) for Males and Females.

*Significant for	Variable
Males and Females	Diploma Type
	Language
	Age
	Median Family Income (PC)
	High School Average
Females	English placement Level
Males	Disability
Neither Sex	Country of Birth

**Details of significance and beta weights can be found in Appendix 4*

Sensitivity, Specificity and Precision of Male and Female Models

The sensitivity, specificity, precision and other metrics of the three models, extracted when run at a cutoff of 0.40, are summarized by sex in Table 2.13.

Table 2.13 Comparison of 10th Semester Logistic Regression Models by Sex (*Enter Method and Cutoff = 0.40; HS = High School).*

	N	Nagel-kerke R^2	Sensitivity	Specificity	%False Positive	Accuracy	PPV (Precision)	AUC	AUC Rating
Female Model									
Model 1 : High School Average	13686	.158	54.5%	75.5%	24.5%	68.2%	54.0%	.708	Fair
Model 2 : 7 Records Variables (No HS Average)	14566	.045	22.8%	88.7%	11.3%	66.0%	51.6%	.617	Poor
Model 3 : 7 Records Variables & HS Average	12593	.172	52.1%	78.9%	21.2%	70.0%	55.1%	.719	Fair
Male Model									
Model 1 : High School Average	10947	.205	80.1%	53.5%	46.5%	65.8%	59.9%	.733	Fair
Model 2 : 7 Records Variables (No HS Average)	11424	.057	79.9%	35.5%	64.5%	55.9%	51.2%	.637	Poor
Model 3 : 7 Records Variables & HS Average	9851	.212	77.1%	58.2%	41.8%	66.7%	59.9%	.742	Fair
All Student Model									
Model 1 : High School Average	24633	.190	68.3%	66.0%	34.0%	66.9%	57.1%	.726	Fair
Model 2 : 8 Records Variables (No HS Average)	25990	.065	54.7%	64.7%	36.3%	60.8%	50.4%	.636	Poor
Model 3 : *8 Records Variables & HS Average	22444	.203	65.6%	70.0%	30.0%	68.3%	57.6%	.736	Fair

** Includes sex in the model as a variable.*

When we examined the data generated by the models over a range of cutoffs, we found that the sensitivity, specificity and precision of male and female models differed for equivalent cutoffs. Figure 2.2 plots the sensitivity of Model 1 for different cutoffs (probabilities) for males and females. Figure 2.3 does the same for specificity and Figure 2.4 for precision. The ROC curve comparing males and females is shown in Figure 2.5. Figure 2.2 shows that over the range of probabilities, the male model has greater sensitivity (i.e., for equivalent cutoffs, the proportion of males who dropped out who were correctly classified was higher than that of females). The line for males lies above that of females over most of the range. Consequently, a lower cutoff is required for females, compared to males, in order to achieve the same sensitivity. Arrows on the graph compare the sensitivity at a cutoff of 0.40 for males and females. At the cutoff of 0.40, the sensitivity of the female model is 54.5% and of the male model it is 80.1% (Table 2.13). However, the specificity (the percentage of retained students who were classified correctly) was higher for females.

Figure 2.2 Sensitivity of Male and Female 10th Semester Attrition Models At Different Cutoffs *(Using Enter Method, Model 1: High School Average only).*

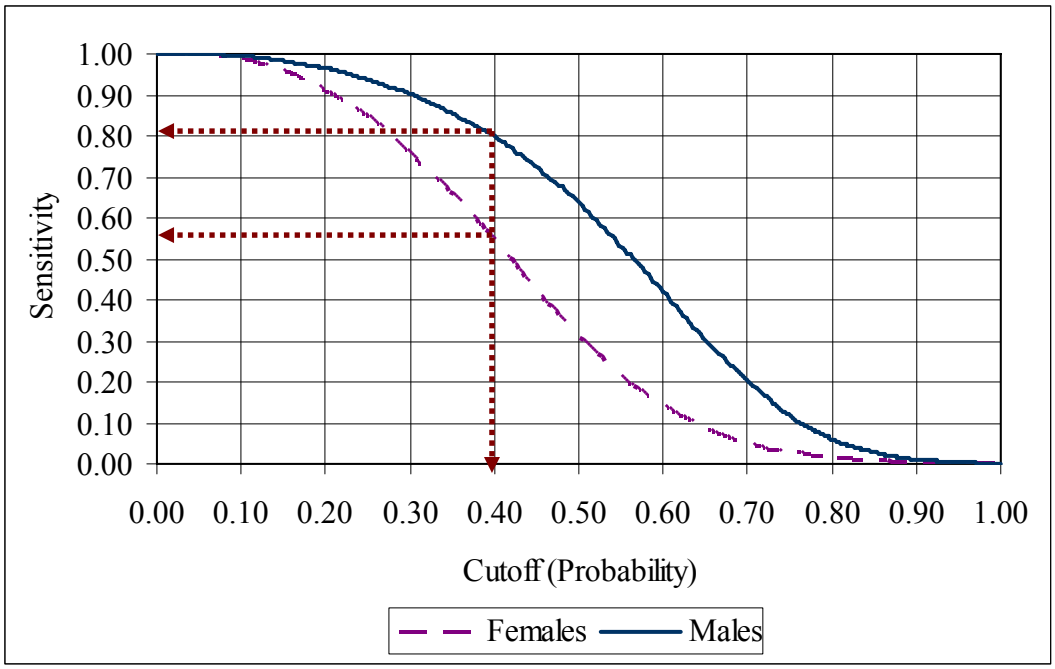


Figure 2.3 Specificity of Male and Female 10th Semester Attrition Models at Different Cutoffs *(Using Enter Method, Model 1: High School Average only).*

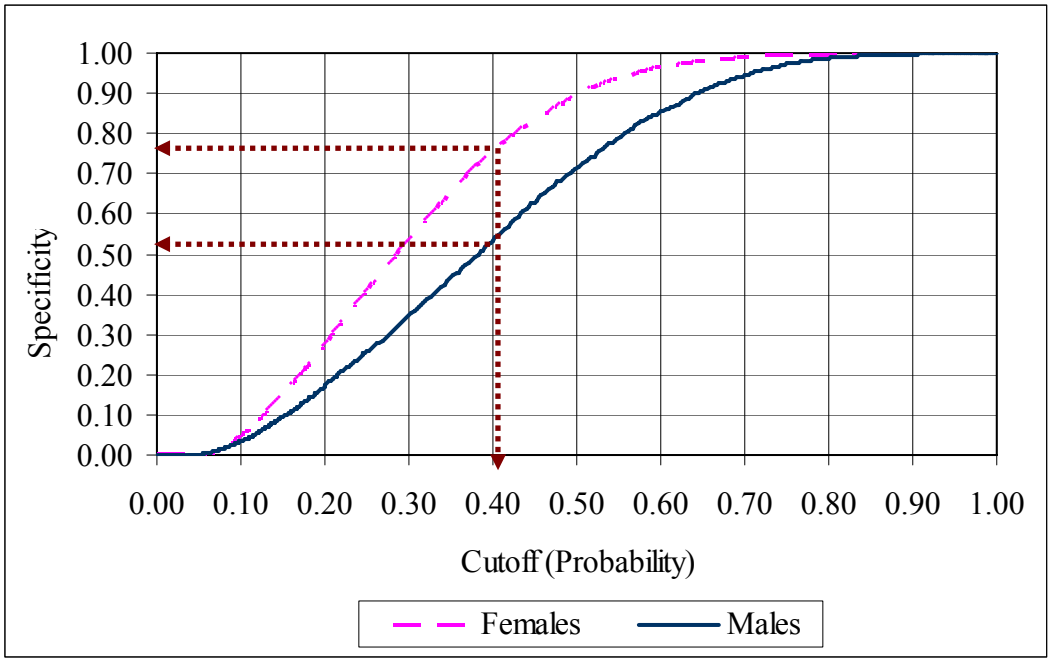


Figure 2.4 Precision of Male and Female 10th Semester Attrition Models at Different Cutoffs *(Model: High School Average only).*

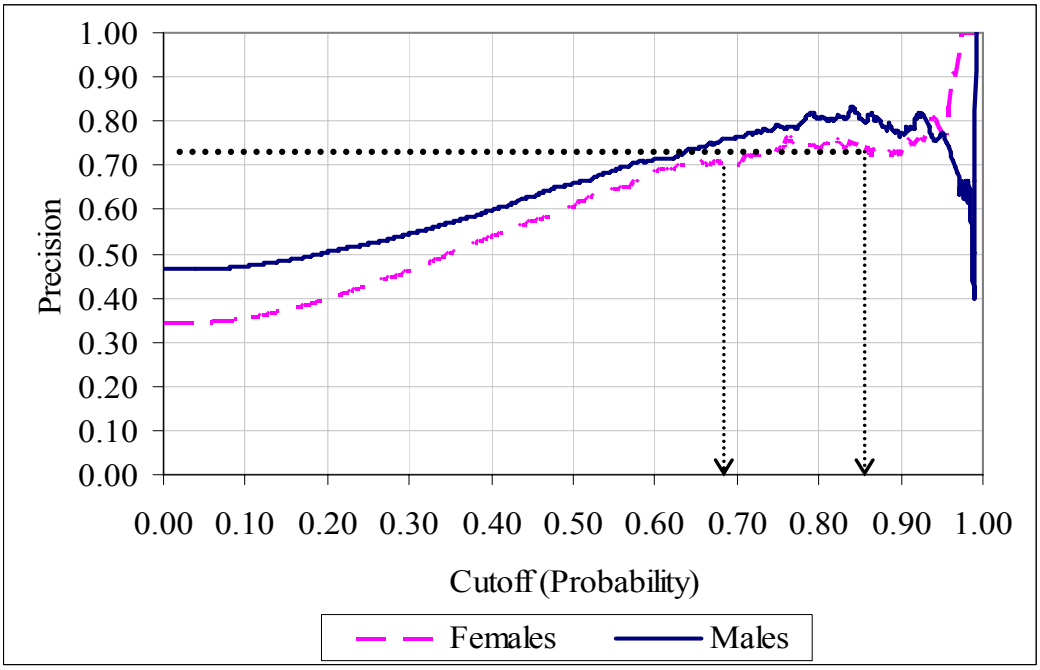


Figure 2.5 Area Under the ROC Curve Comparing Males and Females (Model 1) for 10th Semester Attrition - Showing False Positive Rate for Equivalent Sensitivity.

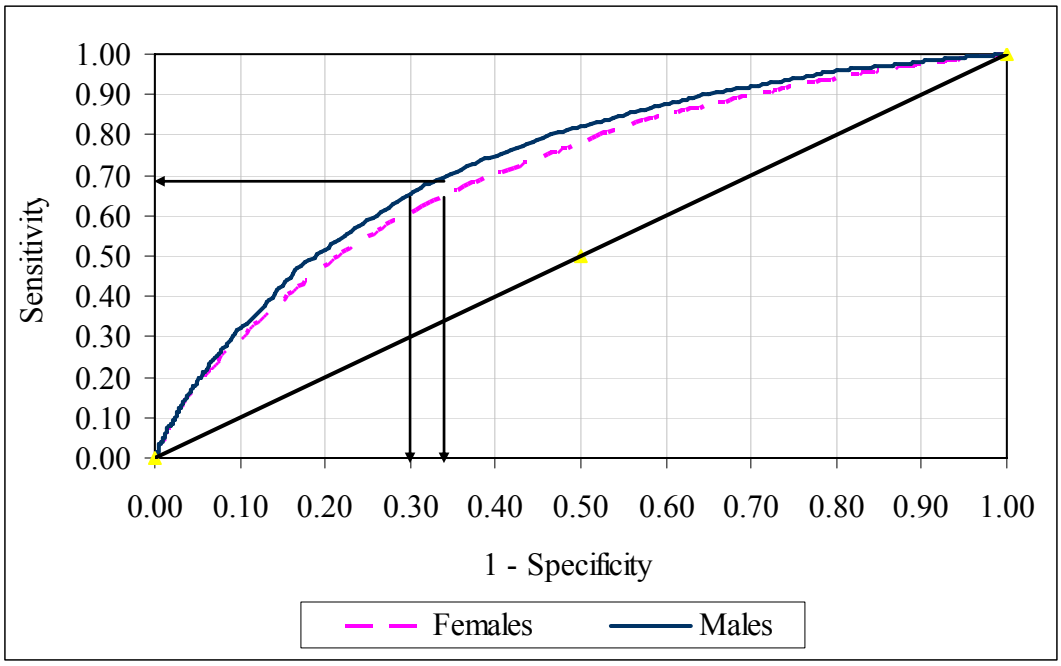


Figure 2.3 shows that the line for females lies above that of males over a range of cutoffs, and that in order to achieve the same specificity, a lower cutoff is required for females. A summary of the differences by sex in the sensitivity, specificity and precision of Model 1 at cutoffs = 0.3, 0.4 and 0.5 are shown in Table 2.14.

The male model also had a higher false positive rate compared to the female model over a range of cutoffs. On the other hand, the female model had higher false negative rates. This can be seen from Table 2.14. For Model 1, the false positive rates for the male model are 18% - 22% higher than those of the female model for equivalent cutoffs. The net effect is that the overall classification accuracy is somewhat higher for females, but the precision is higher for males over the cutoff range (Figure 2.4). However, for equivalent sensitivities, the false positive rates for males were lower, resulting in a greater area under the male ROC curve. A comparison of the areas under the Model 1 ROC curves for males and females is shown in Figure 2.5. The differences by sex in areas under the curves for the three models ranged from .020 - .025, and were significantly higher for males compared to females for all three models (Table 2.15). The variables were, therefore, better able to discriminate between dropout/retention for males than for females.

Table 2.14 Changes in Sensitivity and Specificity Using Different Cutoffs (*Attrition to the 10th Semester Enter Method, Model 1: High School Average only*).

Cutoff		Sensitivity % Drop-out Correct	Specificity % Retained Correct	1-Specificity % False Positive	1 - Sensitivity % False Negative	Accuracy Total % Correct	Precision
.30	Females	75.5%	53.5%	46.5%	24.5%	61.1%	46.1%
.30	Males	90.2%	34.9%	65.1%	9.8%	60.6%	54.9%
.30	Total	84.0%	44.7%	55.3%	16.0%	60.4%	50.3%
.40	Females	54.5%	75.5%	24.5%	45.5%	68.2%	54.0%
.40	Males	80.1%	53.5%	46.5%	19.9%	65.8%	59.9%
.40	Total	68.3%	66.0%	34.0%	30.2%	66.9%	57.1%
.50	Females	30.7%	89.5%	10.5%	69.3%	69.2%	60.7%
.50	Males	64.2%	70.9%	29.1%	35.8%	67.8%	65.7%
.50	Total	48.0%	81.8%	18.2%	52.0%	68.3%	63.7%

Table 2.15 Comparison of the Differences in Areas Under the ROC Curves Between Males and Females

Model	N Females	N Males	Female Area	Male Area	Diff in Area	z	p
Model 1 (HS Average)	13686	10947	.708	.733	.025	3.78	<.01
Model 2 (7 Records Variables)	14566	11424	.617	.637	.020	2.75	<.01
Model 3 (7 Records Variables & HS Average)	12593	9851	.719	.742	.022	3.34	<.01

It is interesting to examine the precision of the models by sex over a range of cutoffs. Figure 2.4 shows that the cutoffs required to obtain similar precisions differ for males and females. For example, to obtain a precision of 54% - 55% requires a cutoff of .30 for males and .40 for females (Table 2.14). By exploiting these differences in model characteristics, it is possible to optimize the precision by selecting different cutoffs. To obtain a sample with 75% precision, would require a cutoff of around .67 for males and .85 or higher for females. This can be seen in Figure 2.5. Although the graph shows that precision increases with the cutoff, there is an upper limit to the precision that can be attained. At higher cutoffs, as the number of students fall the

curve breaks down. This is likely to occur at lower cutoffs with smaller sample sizes, and in samples where the attrition rate is low and there are relatively few students for each cutoff.

The models were also compared on the Nagelkerke R^2. This metric was higher for males compared to females, indicating a stronger association between the independent and dependent variables for males. The Nagelkerke R^2 ranged between .045 and .172 for females and between .057 and .212 for males, depending on the model (Table 2.13).

2.2.5 Students With and Without Disabilities - Attrition to the Tenth Semester

The sample consisted of 757 students with disabilities who had registered with the campus based Services for Students with Disabilities (N = 403 females; N = 354 males) and 21,822 students without disabilities (N = 12,281 females; N = 10,663 males). By the tenth semester, the attrition rates of students with disabilities (39.9%) was slightly lower than that of students without disabilities (42.1%), although the difference was not statistically significant.

We compared two of the three models we tested earlier. Students with and without disabilities were compared on the following:

Model 1: High School Average
Model 3: High School Average & 4 Records variables

Because not all variables were available for all individuals, the sample for students with disabilities was reduced from 757 to 630 (346 females and 284 males). Due to the smaller number of students with disabilities, age, median family income and English placement level were entered as binary variables along with sex. Country of birth, diploma type and language were omitted due to the small numbers of individuals for at least one of the variable levels. The pre-model test for students with disabilities indicated that high school average, age, English placement-test level and sex were significant and had the heaviest weights, in that order. Median family income was marginally significant at p = .05 (Appendix 5). These five variables also had the heaviest weights for students without disabilities. Tables 2.16 and 2.17 summarize the variables significant in the pre-model test for students without and with disabilities respectively, as well as the variables that entered the model.

Table 2.16 Pre-Model Test and Variables Entering 10th Semester Attrition Model – Students Without Disabilities *(N = 21822; Entry Method; Cutoff = 0.40).*

Group	Pre-model Test	Regression Model Variables Entered
Without Disabilities		
Significant	High School Average	High School Average
	Age	Age
	English Placement Level	English placement Level
	Sex	Sex
	Median Family Income (PC)	Median Family Income (PC)
	Diploma Type	Diploma Type
	Language	Language
Not Significant	Country of Birth	Country of Birth

Table 2.17 Pre-Model Test and Variables Entering the 10th Semester Attrition Model - Students With Disabilities *(N = 562; Entry Method; Cutoff = 0.40).*

Group	Pre Model Test	Regression Model Variables Entered
Significant		
	High School Average	High School Average
	Age	
	English Placement Level	
	Sex	
	Median Family Income (PC)*	Median Family Income (PC)
Not Significant		
		Age
		English placement Level
		Sex

** Significance was marginal at p = .052. Country of Birth, Language and Diploma Type were not included.*

When the eight variables were entered into the logistic regression for students without disabilities, all variables were significant with the exception of the country of birth (Table 2.16). For students with disabilities, only high school average and median family income were significant (Table 2.17). Details of the Wald statistic and probabilities are provided in Appendix 5.

Table 2.18 summarizes the model parameters for students with and without disabilities. For students without disabilities, in addition to the high school average, six of the seven Records variables examined made some contribution to the model. However, adding these variables to the high school average added little to improve the precision or accuracy of the model over that achieved using the high school average alone. For students with disabilities, in addition to the high school average, the median family income entered the model, but again did not improve the accuracy or precision of the model over that achieved by the high school average alone. This can be seen visually by examining Figure 2.6, which plots the ROC curves for both models, and compares students with and without disabilities. The difference in area between Model 1 and Model 3 (.022) for students with disabilities was not significant. The difference of .009, although small, was significant for students without disabilities ($z = 2.05$, $p = .04$).

Figure 2.6 shows that the data for students without disabilities was a better fit for both models (i.e., the curve was steeper for both Model 1 and Model 3). There was a significant difference in the areas under the ROC curves between students with and without disabilities for Model 1 ($z = 2.64$, $p = .01$) and a marginally significant difference for Model 3 ($z = 1.96$, $p = .05$). The AUC's for students with disabilities were judged 'poor', whereas those for students without disabilities were judged 'fair' indicating a weaker association between the variables and 10^{th} semester attrition for students with disabilities.

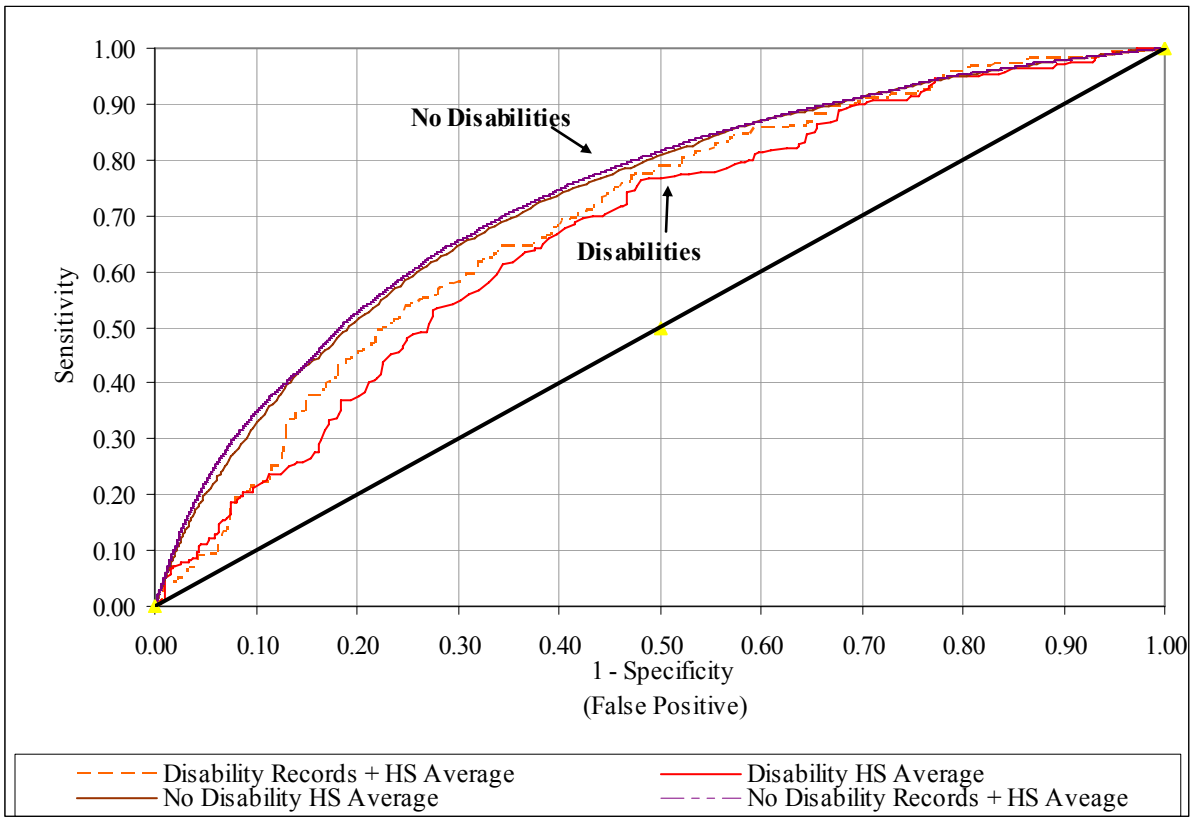
It should be noted that the larger standard errors of the areas under the ROC curves for students with disabilities made it more difficult to show statistical significance. The standard errors for students with disabilities were of the order of .02 - .03 whereas for students without disabilities they ranged between .002 and .005. These larger standard errors are likely related to the smaller sample sizes for students with disabilities. The reliability of estimates decline when there are few

cases for each observed combination of independent variables, and in small samples one may get high standard errors (Peducci et al., 1996).

Table 2.18 Sensitivity, Specificity and Precision of 10th Semester Attrition Models, Comparing Students With and Without Disabilities *(Enter Method and Cutoff = 0.40; HS = High School).*

Group	N	Nagel-kerke R^2	Sensitivity	Specificity	False Positive	Accuracy	Precision	AUC	Assess AOC
With Disabilities									
Model 1 High School Average	630	.106	59.6%	66.2%	33.8%	63.7%	52.0%	.670	Poor
Model 3 (7 Records Variables & HS Average)	562	.143	58.9%	69.3%	30.7%	65.5%	52.8%	.696	Poor
Without Disabilities									
Model 1 High School Average	24033	.193	68.7%	65.8%	34.2%	66.9%	57.1%	.728	Fair
Model 3 (7 Records Variables & HS Average)	21822	.210	65.0%	70.4%	29.6%	68.3%	57.7%	.737	Fair

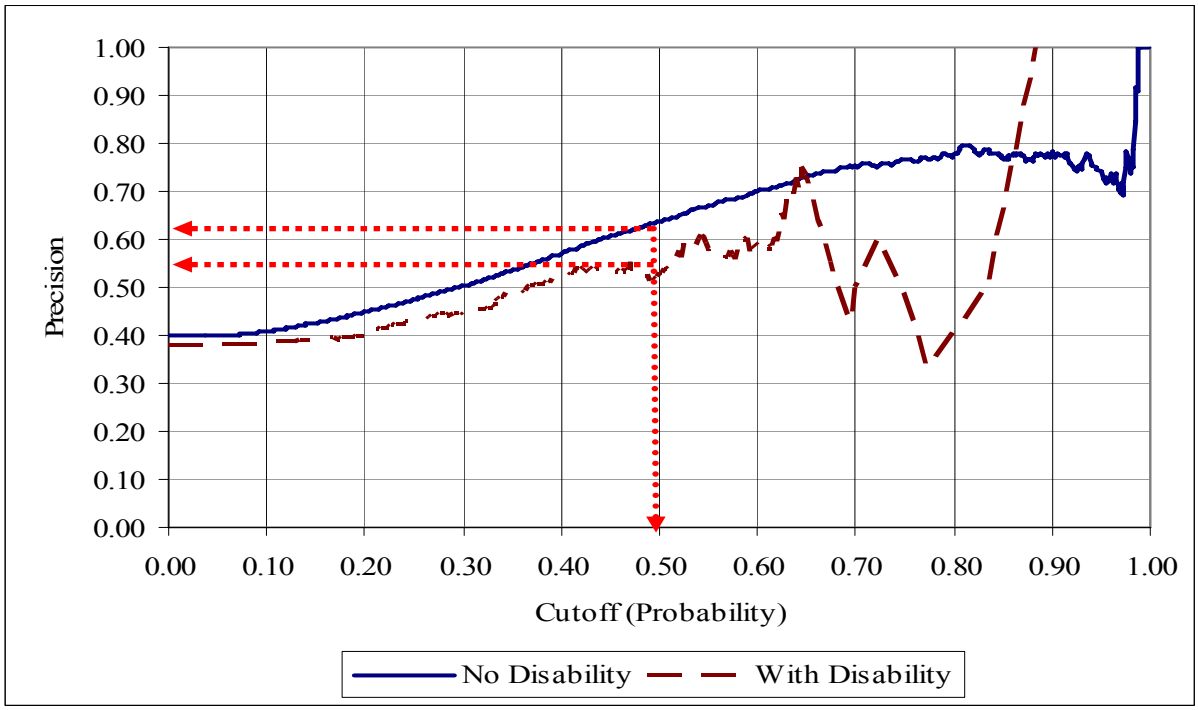
Figure 2.6 Comparison of 10th Semester Attrition For Model 1 (High School Average) and Model 3 (Records Variables and High School Average) by Disability (*Enter Method; Cutoff =0 .40*).



For equivalent cutoffs, the precision was lower for students with disabilities compared to those without. Figure 2.7 plots the precision vs cutoff for both groups. The line for students with disabilities lies below that of students without disabilities over most of the range, indicating lower model precision for equivalent cutoffs.

To obtain the same model precision, a higher cutoff is required for students with disabilities. However, because of the smaller sample size for students with disabilities, the model breaks down due to small numbers in the higher probability range. Therefore, in practical terms the maximum precision that can be achieved is lower for students with disabilities. The lower Nagelkerke R^2 for students with disabilities indicates that the strength of the association between the dependent and independent variables is weaker than for students without disabilities (Table 2.18).

Figure 2.7 Precision of 10th Semester Attrition of Model 1 at Different Cutoffs by Disability
(Curve breaks down at high cutoffs because of the low numbers of students in this probability range)



2.2.6 Comparing 10th Semester Attrition - Male and Female Students With and Without Disabilities

The outcomes for Model 1 (High School Average), Model 2 (Records Variables) and Model 3 (High School Average & Records Variables) were compared for males and females with and without disabilities and the results are shown in Table 2.19. The areas under the male ROC curves are larger than the areas under the female curves for both groups (Figure 2.8). The differences in the areas were of a similar order of magnitude (Model 1: Students with Disabilities: 0.023; Students Without Disabilities: 0.026), but the difference was only statistically significant for students without disabilities ($z = 3.82$, $p < .01$). Figure 2.8 shows that the relationship between male and female ROC curves was consistent across disability (i.e., the female ROC curves fell below the male curves). The patterns were also consistent by sex across disability for the precision and sensitivity graphs (Appendix 6). As was the case in our earlier analysis, Model 2 (excluding the high school grade) was inferior to the other two models for all groups.

Figure 2.8 Comparison of Areas Under the ROC Curves for Males and Females With and Without Disabilities *(Model 1 - High School Average; Attrition to the Tenth Semester).*

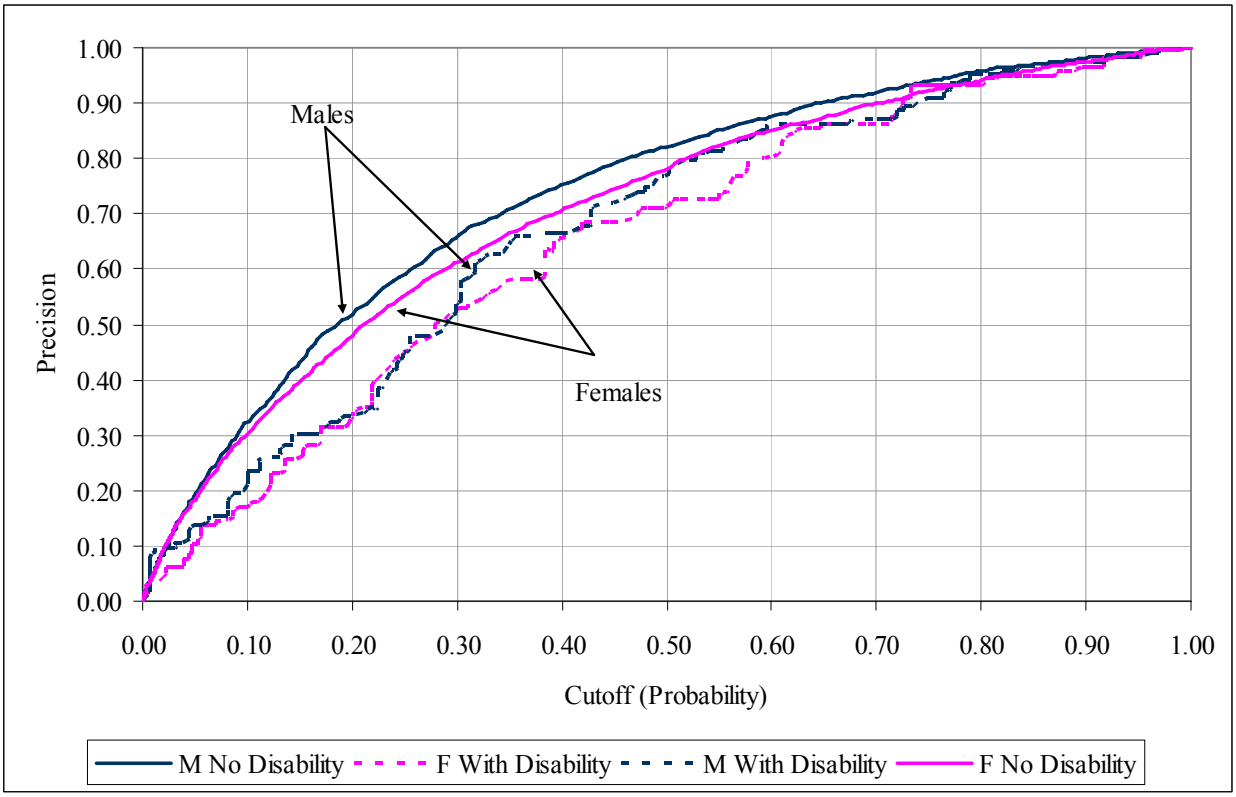


Table 2.19 Sensitivity, Specificity and Precision of the 10th Semester Logistic Regression Models, Comparing Students by Sex and Disability *(Enter Method and Cutoff = 0.40; HS = High School).*

Model	N	Nagel-kerke R^2	Sensitivity	Specificity	False Positive	Accuracy	Prec-ision	AUC	Assess AUC
Females Without Disabilities									
Model 1 (High School Average)	13340	.161	55.1%	75.3%	24.7%	68.3%	54.1%	.710	Fair
Model 2 (6 Records Variables)	14221	.077	36.7%	83.0%	17.0%	67.0%	53.3%	.621	Poor
Model 3 (6 Records Variables & HS Avg)	12281	.178	51.5%	79.0%	21.0%	69.8%	54.9%	.720	Fair
Females With Disabilities									
Model 1 (HS Average)	346	.076	35.0%	79.0%	21.0%	64.2%	46.1%	.652	Poor
Model 2 (3 Records Variables)	345	.016	6.9%	96.2%	3.8%	67.0%	46.7%	.561	Fail
Model 3 (3 Records Variables & HS Avg)	312	.123	43.1%	78.1%	21.9%	66.7%	48.9%	.687	Poor
Males Without Disabilities									
Model 1 (HS Average)	10663	.208	80.3%	53.4%	46.6%	65.9%	60.0%	.735	Fair
Model 2 (6 Records Variables)	11139	.089	63.2%	57.4%	42.6%	60.0%	55.8%	.631	Poor
Model 3 (6 Records Variables & HS Avg)	9601	.219	76.6%	58.3%	41.7%	66.5%	59.8%	.741	Fair
Males With Disabilities									
Model 1 (HS Average)	284	.127	74.0%	52.2%	47.8%	61.6%	54.2%	.675	Poor
Model 2 (3 Records Variables)	285	.088	58.1%	61.4%	38.6%	60.0%	52.1%	.648	Poor
Model 3 (3 Records Variables & HS Avg)	250	.161	72.4%	66.2%	33.8%	68.8%	60.8%	.707	Fair

2.2.7 Third Semester Attrition

There were very few students with disabilities who had a language other than English, who were born outside of Canada or enrolled in career programs. Consequently, the sample adequacy criteria was not met for these variables. Therefore, only three Records variables (excluding sex and disability which were selection variables), and the high school grade were used to model third semester attrition for students with disabilities. We also had to exclude the survey variables for the same reason. As we included only variables obtained from the students' Records, the sample size for students with disabilities was N = 1096 (Females, N = 570; Males, N = 526). These students were compared to students without disabilities for the same cohorts.

Difference in Attrition by Level of Variable

The largest differences in attrition by level of variable were for high school average and age for both males and females with and without disabilities. Details of the differences in third semester attrition rate by level of variable for the four groups are provided in Appendix 7. A summary comparison of the variables entering the model are compared for students with and without disabilities in Table 2.20. Details of probabilities and model coefficients can be found in Appendix 9.

Three models of third semester attrition were examined for the four groups of students using the following groups of variables.

Model 1 : High School Average
Model 2 : Records Variables
Model 3 : High School Average & Records Variables

A summary of the model characteristics for males and females with and without disabilities is shown in Tables 2.21 and 2.22, respectively. What is clear from a comparison of the two tables is that for students with disabilities, the sensitivities and precisions of the models were lower than for students without disabilities. Although true of males, this was especially true of females. In the case of females with disabilities, Model 1 (High School Average) classified only 6.8% of the females who dropped out by the third semester correctly, compared to 77.6% of their non-disabled peers. It was only marginally significant on the omnibus test (p = .05) and the AUC was rated as 'fail' on our assessment criteria. For males with disabilities, 47.1% of those who dropped out were classified correctly, compared to 88.1% of

males without disabilities. In addition, for both males and females with disabilities, the high school average model (Model 1) had lower precision relative to the Records variables alone (Model 2), especially for females with disabilities where the precision was only 12.1%. As the actual attrition rate for females with disabilities in this sample was around 12%, this result was no better than guessing. For males with disabilities the actual drop rate was around 16%, so all three models for males with disabilities resulted in better than random selection, although the precision was lowest for Model 1. In contrast, for males and females without disabilities Model 1 had the highest AUC's and close to the best precision.

Table 2.20 A Summary of Variables Entering the Logistic Regression Model (Attrition to 3rd Semester) By Sex and Disability *(Enter Method, Cutoff .16).*

Sex	**Without Disabilities**	**With Disabilities**
Males and Females	High School Average Age Language Median Family Income (PC)	
Females Only	English Placement Level	High School Average
Males Only	Country of Birth Diploma Type	Age
Not Significant for Either Males or Females	None	Median Family Income (PC) English Placement Level

**Diploma type, language & country of birth were not used in the disabilities model due to low numbers for at least one level of the variable.*

Table 2.21 Males and Females With Disabilities - Comparison of Model Sensitivity, Specificity and Precision for 3rd Semester Attrition *(Enter method, Cutoff 0.16. Sex was included as a variable in the 'All Students' Models 2 & 3).*

Model	N	Nagel-kerke R^2	Sensi-tivity	Speci-ficity	% False Positive	Accur-acy	PPV Precision	AUC	Rate Model
Females With Disabilities									
Model 1 (HS Average)	509	.015	6.8%	93.6%	6.4%	83.5%	12.1%	.579	Fail
Model 2 (Records Variables)	510	.060	50.0%	70.3%	29.7%	67.8%	18.9%	.642	Poor
Model 3 (HS Average & Records)	473	.055	29.4%	86.3%	13.7%	80.1%	20.5%	.658	Poor
Males With Disabilities									
Model 1 (HS Average)	449	.032	47.1%	52.9%	47.1%	55.2%	21.7%	.602	Poor
Model 2 (Records Variables)	457	.032	50.7%	67.4%	32.6%	64.6%	22.8%	.605	Poor
Model 3 (HS Average & Records)	415	.042	49.2%	67.7%	32.3%	64.8%	22.1%	.625	Poor
All Students With Disabilities									
Model 1 (HS Average)	958	.027	32.6%	74.3%	25.7%	68.6%	16.9%	.600	Poor
Model 2 (Records Variables)	967	.043	45.9%	73.4%	26.6%	69.6%	21.9%	.625	Poor
Model 3 (HS Average & Records)	888	.050	38.8%	77.5%	22.5%	72.4%	20.5%	.644	Poor

Table 2.22 Males and Females Without Disabilities - Comparison of Model Sensitivity, Specificity and Precision for 3rd Semester Attrition *(Enter method, Cutoff .16. Sex was included as a variable in the 'All Students' Models 2 &3).*

Model	N	Nagelkerke R^2	Sensi-tivity	Speci-ficity	% False Positive	Accur-acy	PPV Precision	AUC	Rate Model
Females Without Disabilities									
Model 1 (HS Average)	18323	.086	77.6%	45.4%	54.6%	51.7%	25.6%	.670	Poor
Model 2 (Records Variables)	19560	.062	70.9%	45.0%	55.0%	50.2%	24.4%	.628	Poor
Model 3 (HS Average & Records)	17244	.108	73.1%	53.0%	47.0%	56.8%	26.7%	.689	Poor
Males Without Disabilities									
Model 1 (HS Average)	14066	.126	88.8%	32.2%	67.7%	46.4%	30.5%	.703	Fair
Model 2 (Records Variables)	14796	.071	93.7%	8.7%	91.3%	30.2%	25.7%	.631	Poor
Model 3 (HS Average & Records)	12976	.142	85.9%	38.4%	61.6%	49.7%	31.8%	.712	Fair
All Students Without Disabilities									
Model 1 (HS Average)	32389	.109	83.5%	39.5%	60.5%	49.1%	27.9%	.690	Poor
Model 2 (Records Variables)	34356	.070	81.6%	30.6%	69.4%	42.0%	25.2%	.635	Poor
Model 3 (HS Average & Records)	30220	.126	79.4%	46.3%	53.7%	53.3%	28.3%	.702	Fair

Figure 2.23 outlines the actual third semester attrition rates for males and females with and without disabilities and compares them to the positive predictive value of the model.

Table 2.23 3rd Semester Attrition (Actual Percentage of Students Who Dropped Out) Compared to the PPV (Precision) of the Model.

Disability	Sex	Actual Attrition	Model 1 PPV	Model 2 PPV	Model 3 PPV
With Disabilities	Females	12%	12%	19%	21%
	Males	16%	22%	23%	22%
Without Disabilities	Females	20%	26%	24%	27%
	Males	25%	31%	26%	32%

The actual attrition rates were around 20% and 25% respectively for males and females without disabilities. Consequently, all three models produced some improvement on guessing for females, and Model 1 and Model 3 did so for males. For males and females with disabilities the baseline attrition rates were 12% and 16% respectively. Thus Model 2 and Model 3 were better than guessing for females, and for males all three model were better than guessing. Nonetheless, the model precisions were low in practical terms, with only roughly 1 student in 4 being correctly classified as dropping out in a new sample. The difference in the usefulness of the high school average as a predictor of third semester attrition between students with and without disabilities can best be illustrated by comparing the ROC curves for the three models, plotted in Figure 2.9 for females with, and Figure 2.10 for females without disabilities.

Figure 2.9 Comparison of 3rd Semester Attrition Models – Females Without Disabilities

(Model 1: High School Average, N = 18323; Model 2: Records Variables, N =19560; Model 3: High School Average & Records Variables, N =17244).

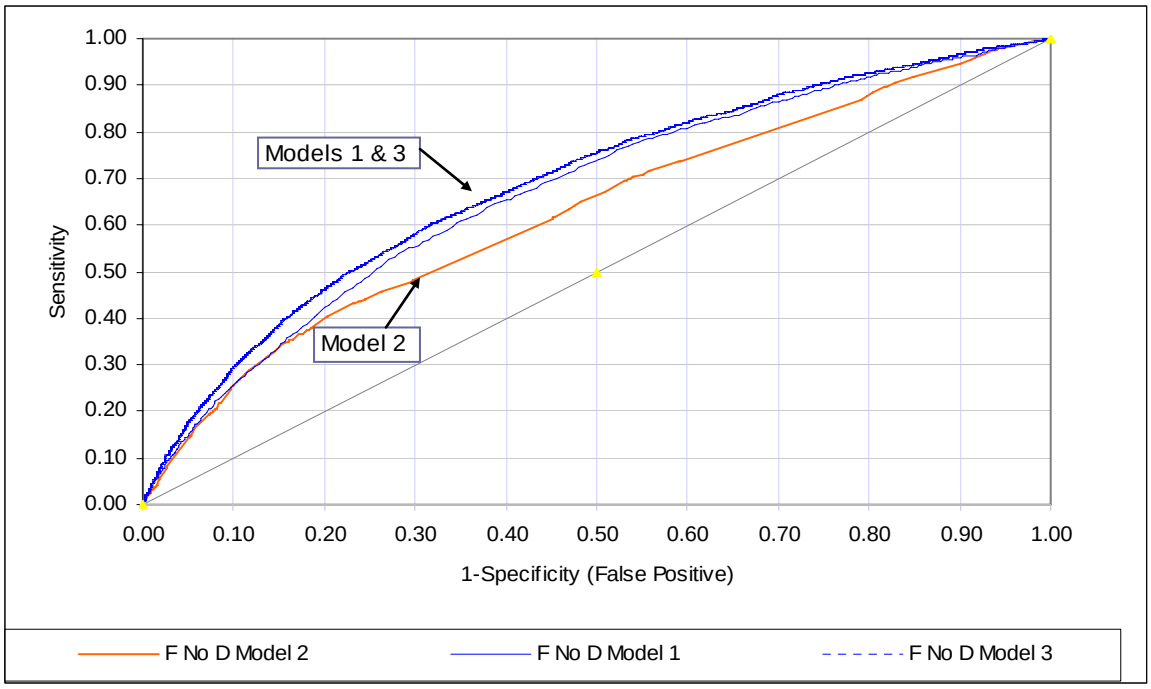
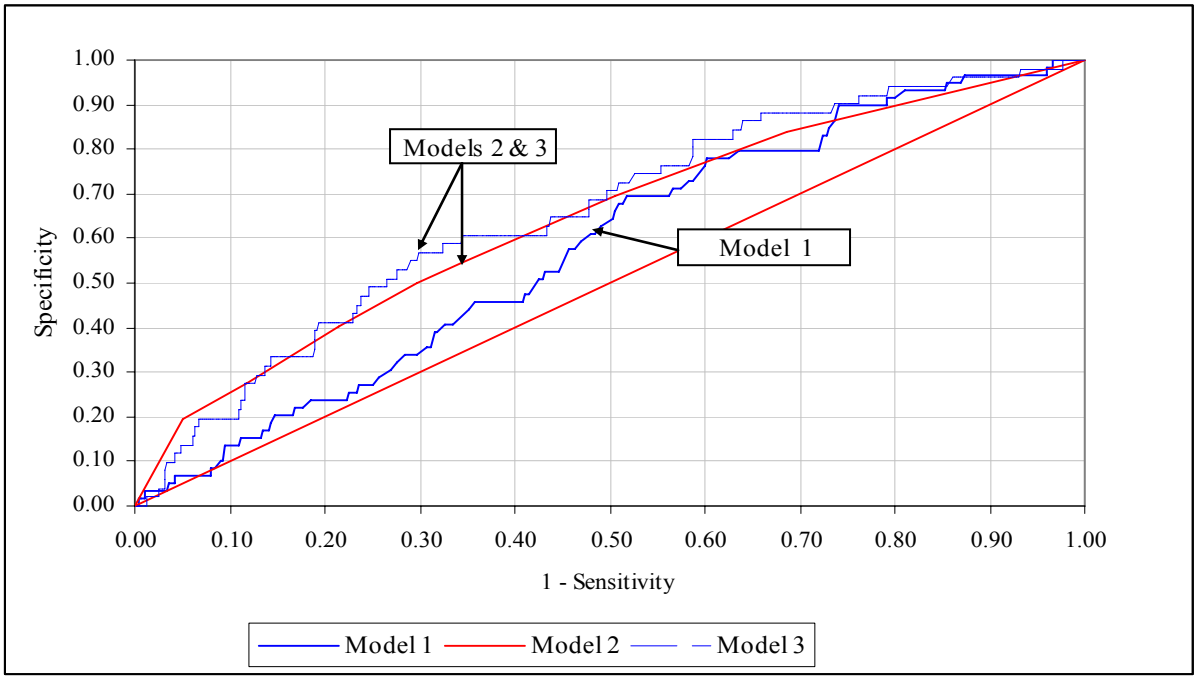


Figure 2.10 Comparison of 3rd Semester Attrition Models – Females With Disabilities

Model 1: High School Average; Model 2: Records Variables; Model 3: High School Average & Records Variables.



Model 1 (High School Average) and Model 3 (Records & High School Average) lie very close together for females without disabilities, although the difference of .018 between the AUC's was significant ($z = 2.63$, $p = .02$). Model 2 (the Records variables alone) lies well below the other two lines. This was the case in the 10th semester attrition model as well. There were significant differences in the AUC's between Model 1 and 2 ($z = 6.43$, $p < .001$) and between Model 3 and 2 ($z = 9.10$, $p<.001$) for females without disabilities. Although not shown here, the pattern for males without disabilities was similar to that of their female counterparts, with significant differences in AUC between Model 1 and Model 2 ($z = 10.43$, $p < .01$) and between Model 3 and Model 2 ($z = 8.34$, $p < .01$). However, for males the difference in the AUC between Models 1 and 3 (.009) was not significant.

On the other hand, from Figure 2.10, which plots the ROC curves for females with disabilities, it can be seen that the Model 1 (High School Average) ROC curve lies below those of Models 2 and 3, and the ROC's for Models 2 & 3 overlap. The difference in the AUC's between Model 2 and Model 3 (1.6%) was not significant. The rather large differences in the AUC's between Model 1 and Model 3 (7.9%) and Model 1 & Model 2 (6.3%) were not significant. For males with disabilities all three curves overlapped and there were no significant differences between the areas under any of the three curves (Appendix 10).

Based on the AUC assessment, most of the third semester attrition model AUC's were rated as a 'poor' fit for the data. The exceptions were Model 1 for females with disabilities, which rated as a 'fail', and Model 1 and Model 3 for males without disabilities, which rated as 'fair' (Tables 2.21 and 2.22). Model 3 for all students combined also rated as fair. In contrast to 10th semester attrition, the high school average was not a good predictor of third semester attrition for students with disabilities; this was especially true for females where the omnibus test of the model was barely significant and the precision was only 12%, no better than what could be achieved from random selection. The Nagelkerke R^2 values for all third semester attrition models were low, ranging from .015 - .06 for students with disabilities and .062 and .142 for students without disabilities, indicating a weaker association between the independent variables and attrition for students with disabilities.

2.2.7 Comparing Third and Tenth Semester Models by Sex and Disability

It is interesting to compare the performance of the third and tenth semester models. Table 2.24 compares the variables that were significant for the two time frames for students without disabilities. For the 10th semester attrition model, all the Records variables, with the exception of the country of birth and English placement level, entered the model for both males and females without disabilities. English placement level was significant for females only, as was the case for the third semester model. Country of birth was not significant for either sex. Four variables were common to both time periods for males as well as females: high school average, age, language, and median family income. Models tracking students to the third semester had lower sensitivities, roughly equivalent specificities and, therefore, lower precision (by around 20%) compared to tenth semester models. The lower precision of the third semester model is shown in Figure 2.11 where the precision at each cutoff is plotted for both 3rd and 10th semester models for females without disabilities. The patterns for the other groups were similar, with the third semester line falling below the tenth semester line over the range of cutoffs. The Nagelkerke R^2 values of the 3rd semester models were much lower than those of the 10th semester models, indicating lower strength of association between the dependent and independent variables for 3rd semester attrition.

Table 2.24 Models for the 3rd and 10th Semester Attrition - Records Variables Entered (Students Without Disabilities) *(10th semester: Females: N = 12281; Males: N = 9601; 3rd Semester: Females N = 17244; Males : N = 12945).*

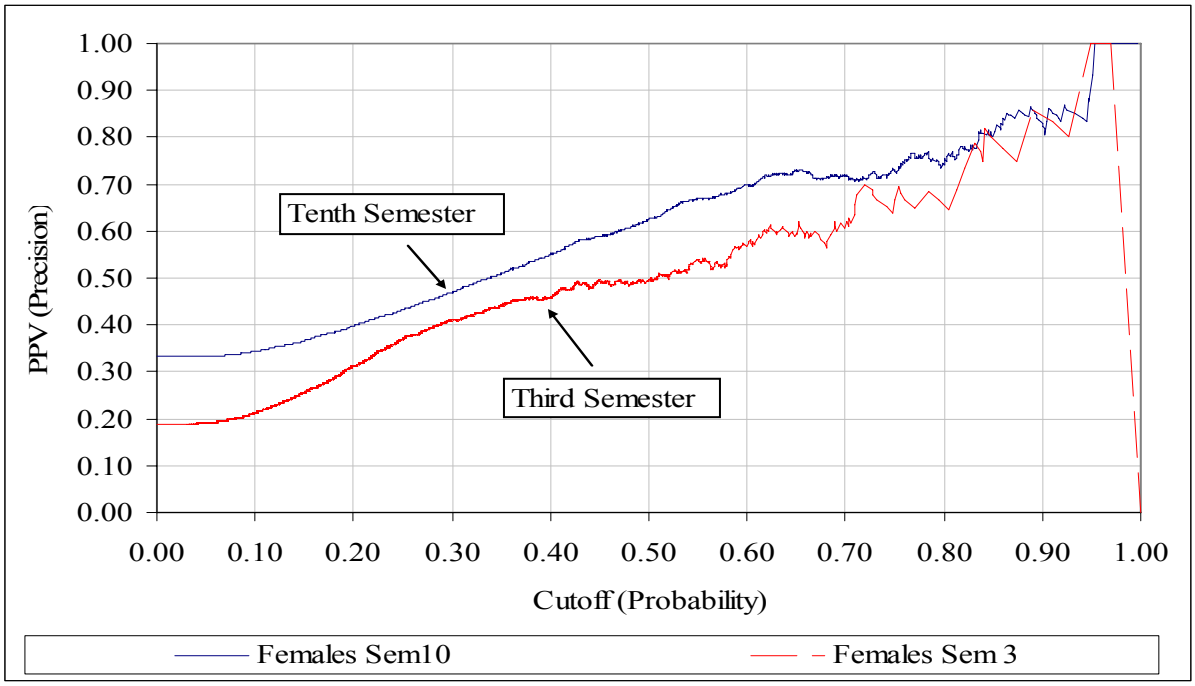
Significant for	3rd Semester	10th Semester
Males and Females	High School Average Age Language Median Family Income (PC)	High School Average Age Language Median Family Income (PC) Diploma Type
Females Only	English Placement Level	English Placement Level
Males Only	Country of Birth Diploma Type	
Not Significant for Either Males or Females	None	Country of Birth

Age and high school average were the important variables for students with disabilities. High school average was the only variable that entered the 10th semester model this group (Table 2.25). Details of the 10th semester models by sex and disability can be found in Appendix 8 and those for the 3rd semester in Appendix 2.9.

Table 2.25 Models for 3rd and 10th Semester Attrition - Variables Entered For Students With Disabilities *(10th Semester: Females: N = 312; Males: N = 346; Third Semester: Females N = 473; Males N = 415).*

	3rd Semester	10th Semester
Males and Females		High School Average
Females Only	High School Average	None
Males Only	Age	None
Neither	Median Family Income (PC) English Placement Level	Median Family Income (PC) English Placement Level Age

Figure 2.11 Precision of 3rd and 10th Semester Models of Attrition (Students Without Disabilities).



2.2.9 Summary - Attrition to 3rd and 10th Semester Using Records Variables

Students Without Disabilities

On the pre-model test for 10th semester attrition, all the variables we tested, with the exception of the country of birth, were significant for both males and females without disabilities giving support to our hypothesis that the factors related to female attrition were also related to male attrition. When we ran the 10th semester regression model, all variables we tested entered both the female and male model with two exceptions - the country of birth, which was not significant for either sex, and the English placement level, which was significant for females only. Consequently, the English placement variable was not strong enough to enter the model for males. High school average, age, median family income and language were robust, and entered the models for both sexes over both time frames. The high school average had the heaviest weight for both groups, and adding the other variables to the model added little to its ability to discriminate between dropout and retention.

Students With Disabilities

When all the records variables were entered into the 10th semester logistic regression model, only the high school average and median income were entered for students with disabilities. The high school average had the heaviest weight and adding the median family income added little to the precision of the model or its ability to discriminate between dropout/retention. For students with disabilities the high school average was not the best predictor of 3rd semester attrition. Consequently, to obtain a better 3rd semester model precision for this group, the Records variables either alone or in concert with the high school average produced a better result over the shorter term.

Males and Females

Male models of attrition showed greater sensitivity than female models, but had higher false positive rates over a range of cutoffs. Female models showed greater specificity but had higher false negative rates relative to males over a range of cutoffs. This was true for both students with and without disabilities. The net effect was that the precision of male models tended to be somewhat higher over the cutoff range. The Nagelkerke R^2 indicated a stronger relationship between the independent and dependent variable for males with and without disabilities compared to their female counterparts. The AUC's under the curves for males were also higher, indicating a better ability to discriminate between retention and attrition and lending weight to

our hypothesis that the relative importance of the variables is different depending on sex. In practical terms this means that models we developed were able to predict male dropout better than female dropout and dropout for students without disabilities more precisely than for students with disabilities.

3rd and 10th Semester Attrition Models

Generally, for both 3rd and 10th semester attrition the high school average was the strongest predictor, with the remaining variables having less favorable metrics, or adding little to the accuracy or precision when combined with the high school average. However, in the absence of information on high school averages, models that excluded the high school average were able to predict attrition at better than chance levels for students with and without disabilities with few exceptions. However, the predictive value of the 3rd semester models, although better than chance, was low.

Modeling attrition over the longer term increased sensitivity and precision, and the chances of correctly predicting students at risk. This can be partly attributed to the fact that the 60:40 split in the dependent variable (retention/attrition) for the 10th semester model makes it easier to detect a difference than the 80:20 split characteristic of the 3rd semester. As pointed out by Garson (2009), it is easier for a predictor variable to have an effect the closer the split is to 50:50. With more lopsided split is difficult for a predictor to improve on simple guessing. Weak predictors may be significant, but may not move the model's predictive value enough to improve on guessing.

2.3 Attrition by Diploma Type

We tested six Records variables and the high school average in the logistic regression models for students without disabilities enrolled in two-year pre-university and three-year career programs. There were not enough students with disabilities in career programs to develop meaningful models. In the model pre-test all variables were significant, with the exception of country of birth for both diploma types and median income for career programs. High school average, age and sex were the variables with the heaviest weights for both groups. The variables entering the logistic regression model are summarized in Table 2.26. The details of model outcomes and probabilities are provided in Appendix 11. The only difference between the diploma types was

that median family income was not significant for the careers sector. Country of birth and English placement level were not significant in either model. For the most part, the variables that contributed to dropout in career programs also contributed to dropout in pre-university programs. Median family income, however, was more of a factor in pre-university programs.

Table 2.26 Variables Contributing to the 10th Semester Attrition Model by Diploma Type *(Pre-university N = 16644; Careers N = 324).*

Significant for:	**Variable**
Both Pre-University and Careers	High School Average Age Language Sex
Pre-University Only	Median Family Income (PC)
Careers Only	None
Neither Pre-University nor Careers	Country of Birth English placement Level

2.4 Incoming Student Survey Data - Demographic and Other Variables

In this section we compare the ability of a number of variables collected annually on the Incoming Student Survey (ISS) to predict attrition for males and females, and we examine whether these variables, when combined with the high school average, improve the sensitivity, specificity and precision of the attrition models. These variables are shown in Table 2.27. As the survey data was only collected for the 2004 to 2006 autumn cohorts, the attrition rate was measured to the beginning of the 3rd semester.

At this time all three cohorts would have had the opportunity to enroll in the 3rd semester. In our initial analysis we examined the difference in attrition by level of variable for the four target groups, and then explored the factors that were most predictive of attrition for the groups of interest.

Table 2.27 Demographic and Background Variables Collected From Survey Data

Variable	Variable Type	Levels	Code
First Generation College Student	Categorical	0: First generation 1: Not First Generation	First_Gen01
Program Choice (Whether the program was the students first or higher choice)	Categorical	0: First Choice 1: Second Choice or Higher	Choice01
Country of Birth Mother	Categorical	0: Other Country 1: Canada	POBM01
Country of Birth Father	Categorical	0: Other Country 1: Canada	POBF01
Motivation (Student self-identified level of motivation)	Categorical	0: Average or Lower 1: High or Very High	Motivation01
Level of Studies (Students hope to attain)	Categorical	1: DEC 2: Bachelor's Degree 3: Master's Degree 4: PhD (Doctorate) or 0: Diploma/Bachelor 1: Master's/PhD	LevelStudies1_4 Level01
Paid Employment (Expected Hours of paid employment in the upcoming semester)	Continuous Categorical Categorical	Or 0 hrs 1-5 hrs 6-10 hrs 11-15 hrs 16-20 hrs >20 hrs 0:15 hrs or less (include 0) 1: > 15 hrs	AvgWorkHrs Paid Employment01
College Study Time (Anticipated time to be spent on out-of-class study at college)	Continuous Categorical	Or 0: <=15 hrs 1: >15 hrs	TimeStudyCollege CollegeTimeGrp01
Study Time Last Year (Time spent on out-of-class study in last year of study)	Categorical Categorical	Less Than 3 Hrs 3-6 Hrs 6-9 Hrs 9-12 Hrs 12-15 Hrs 15-18 Hrs 18-21 Hrs More than 21 Hrs 0: <= 12 hrs 1: > 12 hrs	StudyTime_LastYr Study_LastYr01

2.4.1 Incoming Student Survey (ISS Sample Characteristics)

In the autumn semesters between 2004 and 2006, 7080 Cohort A students entered studies at the college. Cohort A students are defined as those who were studying at a college in the province of Quebec for the first time. Of these, 4456 students (62.9%) replied to the college's Incoming Student Survey. However, as not all students replied to all questions, the numbers in the various analyses that follow will be less than the total shown here. The sample characteristics for the survey responders are shown in Table 2.28. Of the 4456 survey respondents, 150 (3.4%) were students with disabilities registered with the college's Services for Students with Disabilities.

Table 2.28 Sample Characteristics of Students Replying to the Incoming Students Survey.

	Sex	N	%	Average Age
Without Disability	F	2612	60.7%	17.6
	M	1694	39.3%	17.6
	Total	**4306**	**100%**	
With Disability	F	67	44.7%	17.3
	M	83	55.3%	17.4
	Total	**150**	**100%**	
All Students	F	2679	60.1%	17.6
	M	1777	39.9%	17.6
	Total	**4456**	**100%**	**17.6**

The sample of students with disabilities had a higher proportion of males (55.3%) compared to the sample without disabilities (39.3%). The average age of students at the time they commenced their studies was between 17 and 18, and there were no significant differences in the average age of survey responders among the different groups.

2.4.2 Incoming Student Survey Variables and Rates of Attrition

In order to help us build profiles of males and females and students with and without disabilities, we compared the attrition rates for each group by level of the independent variable. This allowed us to assess the magnitude of the differences in attrition for each variable for the targeted groups. We then used logistic regression modeling to compare the model characteristics of the four groups and the extent to which the variables shown in Table 2.27 were related to attrition.

The attrition rates to the third semester for students with and without disabilities for the autumn cohorts 2004 to 2006 are shown in Table 2.29. The base rate attrition for females was between 13% and 15% and for males it was around 16%. It should be noted that the attrition rate for the survey responders shown in Table 2.29 was lower than those of the survey non-responders by approximately 3% for females and 6% for males. This highlights one of the problems with using survey data for modeling, as it is possible that the models may be using data from a sample whose characteristics differ from that of the general population.

Table 2.29 Baseline Rates of Attrition to the Third Semester by Sex and Disability – ISS Survey Responders

	Sex		Retained	Attrition	Total
Without Disability	F	N	2219	393	2612
		%	85.0%	15.0%	100
	M	N	1418	276	1694
		%	83.7%	16.3%	100
	Total	N	3637	669	4306
		%	84.5%	15.5%	100
With Disability	F	N	58	9	67
		%	86.6%	13.4%	100
	M	N	70	13	83
		%	84.3%	15.7%	100
	Total	N	128	22	150
		%	85.3%	14.7%	100
All Students	F	N	2277	402	2679
		%	85.0%	15.0%	100%
	M	N	1488	289	1777
		%	83.7%	16.3%	100%
	Total	N	3765	691	4456
		%	84.5%	15.5%	100%

2.4.3 Level of Motivation by Sex and Disability

The majority of students entering the college (over 89% across all groups examined) reported levels of motivation that were high or very high. Students with disabilities had similar proportions in the low/average and high/very high categories when compared to their non-disabled peers (Table 2.30). Overall, a higher proportion of males (10.6%) than females (7.8%) fell in the group reporting the lower motivation levels. A chi square test showed that this sex difference in proportions (2.8%) was significant ($\chi 2$ (1, N = 4436) = 10.14, p <.01).

When differences by sex and disability were examined, there was a significant difference in proportions between males and females for students without disabilities ($\chi 2$ (1, N = 4287) = 9.3, p <.01), but not for those with disabilities, despite the fact that the difference for the group with disabilities was larger. The overall difference between the proportion of males and females falling in the lower levels of motivation was 2.7% for students without disabilities and 4.8% for students with disabilities (Table 2.31). This lack of significance for students with disabilities is likely due to the lower sample size for these students, as the number falling in the low/average group was small (4 females and 9 males). Students with disabilities appear to be as motivated as their non-disabled peers and males somewhat less motivated, as measured by the slightly higher proportion in the low/average category shown in Table 2.30.

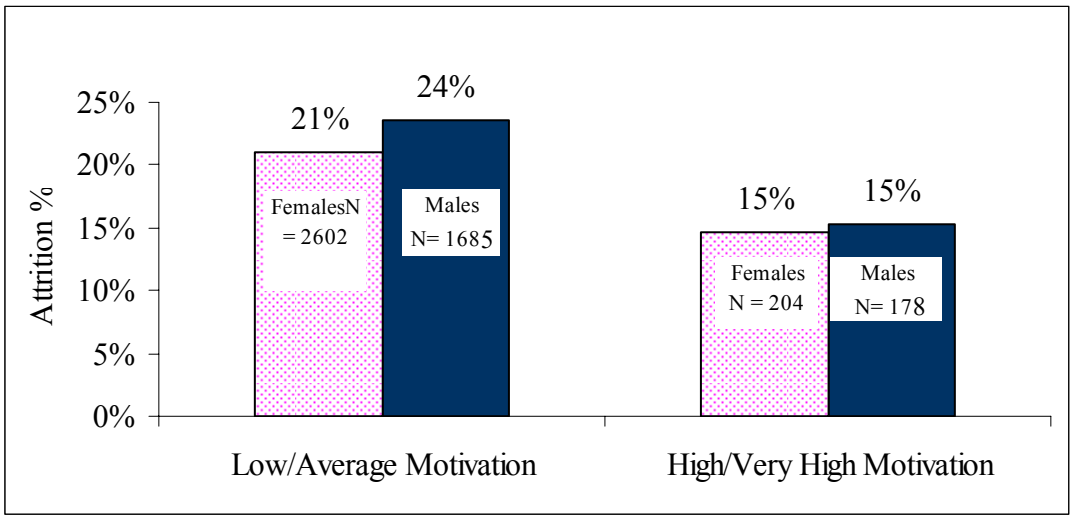
2.30 Percentage of Students With Lower and Higher Levels of Motivation by Sex and Disability.

			Motivation		
Disability	**Sex**		**Low/Average**	**High/Very High**	**Total**
No Disability	Females	N	204	2398	2602
		%	7.8%	92.2%	100
	Males	N	178	1507	1685
		%	10.6%	89.4%	100
	Total Without Disability	N	382	3905	4287
		%	8.9%	91.1%	100
With Disability	Females	N	4	62	66
		%	6.1%	93.9%	100
	Males	N	9	74	83
		%	10.8%	89.2%	100
	Total With Disability	N	13	136	149
		%	8.7%	91.3%	100
Total	Females	N	208	2460	2668
		%	7.8%	92.2%	100
	Males	N	187	1581	1768
		%	10.6%	89.4%	100
	Grand Total	N	395	4041	4436
		%	8.9%	91.1%	100

Although only a small proportion of students reported low to average levels of motivation, those who did so had higher rates of attrition by the third semester. The attrition rate for students who reported lower levels of motivation was significantly higher for both females ($\chi 2$ (1, N = 2602) = 6.25, p = .01) and males ($\chi 2$ (1, N = 1685) = 8.01, p <.01) without disabilities. Figure 2.12 shows

that the difference in attrition rate was 6.5% higher for females and 8.3% higher for males in the low/average category. Because only 4 females and 9 males fell in the low category for students with disabilities, a meaningful analysis of attrition was not possible for this group. However, the rate of attrition for students with disabilities who reported high levels of motivation was 15.4%, a value that was similar to that of students without disabilities (14.9%).

Figure 2.12 Rate of Attrition by the Third Semester by Sex and Level of Motivation (Students Without Disabilities).



2.4.4 Level of Studies Students Hoped to Achieve

Because of the relatively small numbers of students with disabilities, degree groups were combined and the Diploma/Bachelor group was compared to the Masters/PhD for the attrition rate analysis that follows. Only students who provided responses to these categories were included. This represented 84.2% of those who responded to this survey item. However, it should be noted that 14.0% of students who responded to the item claimed they were unsure of what level of qualification they hoped to attain, and another 1.8% indicated some other qualification.

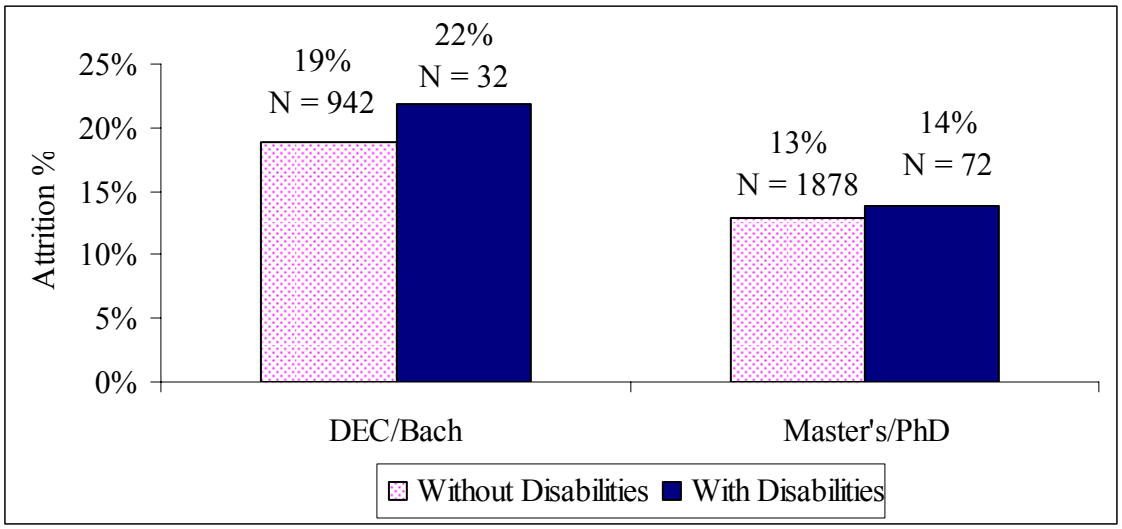
There were no significant differences between students with and without disabilities, or between males and females in the proportion of students falling within each of the degree groupings. Approximately 9% of respondents claimed their aim was to obtain a college diploma, 25% a Bachelor's degree, 42% a Master's degree and 24% a PhD (Table 2.31).

Table 2.31 Degree Aspirations by Sex and Disability.

	Sex		DEC/Bach	Masters/PhD	Total
Without Disabilities	F	N	570	1182	1752
		%	32.5%	67.5%	100
	M	N	372	696	1068
		%	34.8%	65.2%	100
	Total	N	942	1878	2820
		%	33.4%	66.6%	100%
With Disabilities	F	N	14	31	45
		%	31.1%	68.9%	100
	M	N	18	41	59
		%	30.5%	69.5%	100
	Total	N	32	72	104
		%	30.8%	69.2%	100%
All Students	F	N	584	1213	1797
		%	32.5%	67.5%	100
	M	N	390	737	1127
		%	34.6%	65.4%	100
	Total	N	974	1950	2924
		%	33.3%	66.7%	100%

From Figure 2.13 it can be seen that the rate of attrition for students who hoped to attain a Master's degree or PhD was lower than those aspiring to obtain a Diploma or Bachelor's degree. The result of the chi square test was statistically significant for students without disabilities ($\chi 2$ (1, N = 2820) = 17.88, p < . 01), where the difference in attrition between degree groups was 6.0%. However, despite the larger difference in rate of attrition between the degree groups for students with disabilities (8%), the difference was not significant. This may well be due to the smaller sample size for students with disabilities, rather than any real difference between groups.

Figure 2.13 Rates of Attrition By the Third Semester and Degree Aspirations of Students With and Without Disabilities.

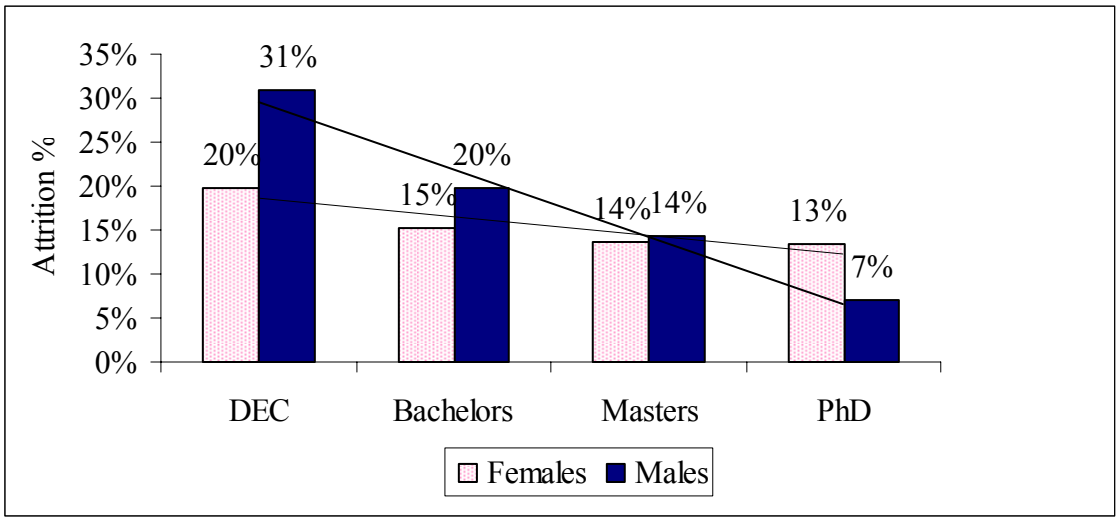


Because of the relatively small numbers of students with disabilities in the group with lower degree aspirations, the attrition rate analysis by sex was confined to students without disabilities. A chi square test showed a statistically significant difference in attrition rate related to level of degree aspirations for males ($\chi 2$ (3, N = 1068) = 34.37, p <.01) but not for females ($\chi 2$ (3, N = 1752) = 4.51, p = .21). The average difference between the two groups was 3.0% for females compared to 10.8% for males. Figure 2.14 provides a more detailed breakdown by degree group and shows a linear relationship between level of degree aspired to and attrition. The attrition rate for males aspiring to a PhD was 7%, compared to 31% for those who aspired to a DEC only. The variable appears to have a more important relationship to attrition for males than for females.

2.4.5 First Generation College Student

A student was classified as a first generation college student if neither parent had attained a qualification at the level of a college diploma or higher. It was derived from the survey item where students were asked to provide information on the level of education of their parents. The proportions of students falling in each of the groups is shown in Table 2.32 .

Figure 2.14 Level of Degree Aspiration and Rate of Attrition by the Third Semester for Males and Females Without Disabilities



Of the 143 students with disabilities, only 3 (2.1%) were first generation college students. The proportion of first generation college students for students without disabilities was 14.4%. This difference in the proportion of first generation college students was statistically significant ($\chi 2$ (1, N = 4247) = 16.64 , p < .01). There was no significant difference in the proportion of first generation college students between sexes and this was true for students with and without disabilities.

As there were only three first generation college students with disabilities, an analysis of attrition was meaningless for this group except to say that the three had dropped out by the beginning of the third semester. The attrition rates for first generation college students for students without disabilities are shown in Table 2.33. There was a statistically significant difference in attrition rates (although marginal) between male students who were first generation college students and those who were not ($\chi 2$ (1, N = 1620) = 3.93, p = .05). The attrition rate for first generation males was 5.3% higher. The difference for females (1.4%) was not significant ($\chi 2$ (1, N = 2484) = 0.5, p = .47).

Table 2.32 Proportion of First Generation College Students By Sex and Disability

	Sex		Not First Gen	First Gen	Total
Without Disability	F	N	2125	359	2484
		%	85.5%	14.5%	100
	M	N	1405	215	1620
		%	86.7%	13.3%	100
Total Without Disabilities		**N**	**3530**	**574**	**4104**
		%	**85.6%**	**14.4%**	**100**
With Disability	F	N	62	2	64
		%	96.9%	3.1%	100
	M	N	78	1	79
		%	98.7%	1.3%	100
Total With Disability		**N**	**140**	**3**	**143**
		%	**97.9%**	**2.1%**	**100**
All Students	F	N	2187	361	2548
		%	85.8%	14.2%	100
	M	N	1483	216	1699
		%	87.3%	12.7%	100
Total All Students		**N**	**3670**	**577**	**4247**
		%	**86.4%**	**13.6%**	**100**

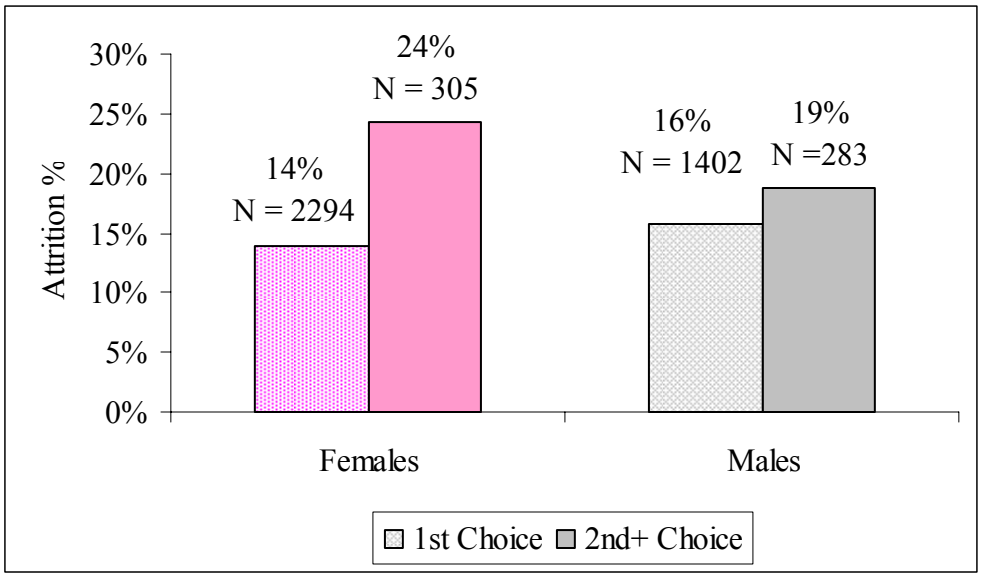
Table 2.33 Attrition Rates and First Generation College Status by Sex (Students Without Disabilities)

Sex	Level of Variable		Ret	Att	Total
Females	Not First Generation	N	1824	301	2125
		%	85.8%	14.2%	100%
	First Generation	N	303	56	359
		%	84.4%	15.6%	100%
	Total Females	N	2127	357	248
		%	85.6%	14.4%	100
Males	Not First Generation	N	1192	213	1405
		%	84.8%	15.2%	100
	First Generation	N	171	44	215
		%	79.5%	20.5%	100%
	Total Males	N	1363	257	1620
		%	84.1%	15.9%	100
All Students	Not First Generation	N	3016	514	3530
		%	85.4%	14.6%	100
	First Generation	N	474	100	574
		%	82.6%	17.4%	100%
	Total Without Disabilities	N	3490	614	4104
		%	85.0%	15.0%	100%

2.4.6 First Choice Program

The majority of students with (90.5%) and without (86.3%) disabilities claimed to be in their first choice program, and there was no significant difference between the two groups with respect to these proportions. However, a lower proportion of males without disabilities were in their first choice program (83.2%) compared to females (88.3%), and this difference was significant ($\chi 2$ (1, N = 4432) = 22.10, $p < .01$). The rate of attrition as it relates to first choice program is shown in Figure 2.15.

Figure 2.15 Rate Attrition and First Choice Program - Students Without Disabilities



The small number of students with disabilities in second or third choice programs (14) made an analysis of attrition meaningless for students with disabilities falling in this group (Table 2.34). The attrition rate for students with disabilities in their first choice program (15.7%) was comparable to those of students without disabilities (14.6%). This 1.1% difference was not statistically significant.

The rate of attrition of females without disabilities who were not in their first choice program (24.3%) was 10.4% higher than that of females who were (13.8%). This difference was statistically significant ($\chi 2$ (1, N = 2599) = 22.97, $p < .01$). The difference for males without disabilities (2.9%) was not significant. Entering a second or higher level of choice of program was more of a risk factor for females without disabilities than for males.

Table 2.34 Rate of Attrition and First Choice Program by Sex and Disability.

	Sex	Choice		Retained	Attrition	Total
Without Disabilities	F	2nd or Higher Choice	N	231	74	305
			%	75.7%	24.3%	100
		First Choice	N	1977	317	2294
			%	86.2%	13.8%	100
		Total	**N**	**2208**	**391**	**2599**
			%	**85.0**	**15.0**	**100%**
	M	2nd or Higher Choice	N	230	53	283
			%	81.3%	18.7%	100%
		First Choice	N	1180	222	1402
			%	84.2%	15.8%	100%
			N	**1410**	**275**	**1685**
		Total	**%**	**83.7%**	**16.3%**	**100%**
With Disabilities	F	2nd or Higher Choice	N	5	0	5
			%	100%	0	100
		First Choice	N	53	9	62
			%	85.5%	14.5%	100%
		Total	**N**	**58**	**9**	**67**
			%	**86.6%**	**13.4%**	**100%**
	M	2nd or Higher Choice	N	8	1	9
			%	88.9%	11.1%	100
		First Choice	N	60	12	72
			%	83.3%	16.7%	100%
			N	**68**	**13**	**81**
		Total	**%**	**84.0%**	**16.0%**	**100%**
All Students	F	Second or Higher	N	236	74	310
			%	76.1%	23.9%	100
		First Choice	N	2030	326	2356
			%	86.2%	13.8%	100
			N	**2266**	**400**	**2666**
		Total	**%**	**85.0%**	**15.0%**	**100%**
	M	Second or Higher	N	238	54	292
			%	81.5%	18.5%	100
		First Choice	N	1240	234	1474
			%	84.1%	15.9%	100%
			N	**1478**	**288**	**1766**
		Total	**%**	**83.7%**	**16.3%**	**100%**
Grand Total		2nd or Higher Choice	N	474	128	602
			%	78.7%	21.3%	100
		First Choice	N	3270	560	3830
			%	85.4%	14.6%	100%
			N	**3744**	**688**	**4432**
		Total	**%**	**84.5%**	**15.5%**	**100%**

2.4.7 Mother's Place of Birth by Sex and Disability

Forty-four percent of students without disabilities had mothers who were born outside of Canada compared to 38.4% of students with disabilities (Table 2.35). This difference was not statistically significant. A higher proportion of males (45.9%) than females (42.4%) had mothers born outside of Canada and the difference of 3.5% was significant ($\chi 2$ (1, N = 4401) = 5.38, p = .02).

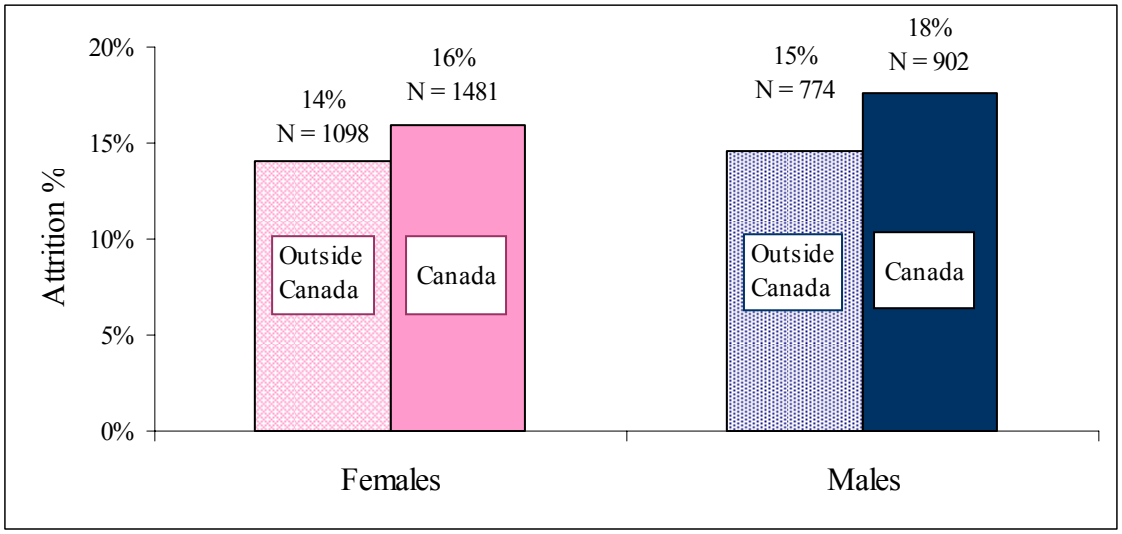
Table 2.35 Percentage of Students Who Had Mothers Born Outside of Canada.

			Outside Canada	Canada	Total
Without Disability	F	N	1098	1481	2579
		%	42.6%	57.4%	100
	M	N	774	902	1676
		%	46.2%	53.8%	100
		N	**1872**	**2383**	**4255**
	Total	**%**	**44.0%**	**56.0%**	**100**
With Disability	F	N	22	41	63
		%	34.9%	65.1%	100
	M	N	34	49	83
		%	41.0%	59.0%	100
		N	**56**	**90**	**146**
	Total	**%**	**38.4%**	**61.6%**	**100**
All Students	F	N	1120	1522	2642
		%	42.4%	57.6%	100
	M	N	808	951	1759
		%	45.9%	54.1%	100
		N	**1928**	**2473**	**4401**
	Total	**%**	**43.8%**	**56.2%**	**100**

Males with disabilities whose mothers were born outside of Canada had a lower attrition rate (5.9%) than males with mothers born in Canada (22.4%). This difference was statistically significant ($\chi 2$ (1, N = 83) = 4.17, p = .04). The difference in attrition rate for males without disabilities (3.0%) was marginally significant ($\chi 2$ (1, N = 1676) = 2.17, p = .05).

There were no significant differences for females and their rates were consistent with the base rates of between 15% - 16% (Figure 2.16).

Figure 2.16 Mothers' Place of Birth and Attrition to the Third Semester (Students Without Disabilities).



2.4.8 Fathers' Place of Birth by Sex and Disability

A higher proportion of males (51.3%) than females (47.4%) had fathers born outside Canada ($\chi 2$ (1, N = 4375) = 6.51, p = .01). A lower proportion of students with disabilities (40.7%) had a father born outside Canada compared to students without disabilities (49.3%). This 8.6% difference was statistically significant ($\chi 2$ (1, N = 4375) = 4.13, p = .04).

Overall, the attrition rate was 3.3% lower for students whose fathers were born outside Canada (Figure 2.17). This difference was significant ($\chi 2$ (1, N = 4375) = 9.34, p < .01). This pattern held true for both males and females without disabilities (Females: $\chi 2$ (1, N = 2558) = 3.84, p = .05; Males: $\chi 2$ (1, N = 1672) = 6.28, p = .01). However, there were no significant differences in rate of attrition for students with disabilities.

2.4.9 Hours of Paid Employment

Overall, 54.6% of students claimed they would have some form of paid employment during the upcoming semester. A higher proportion of females (56.4%) than males (51.8%) claimed they would be employed ($\chi 2$ (1, N = 4530) = 9.04, p < .01). However, this difference was significant only for students without disabilities ($\chi 2$ (1, N = 4204) = 7.57, p = .01) (Figure 2.18).

Figure 2.17 Rate of Attrition and Father's Place of Birth - Students Without Disabilities

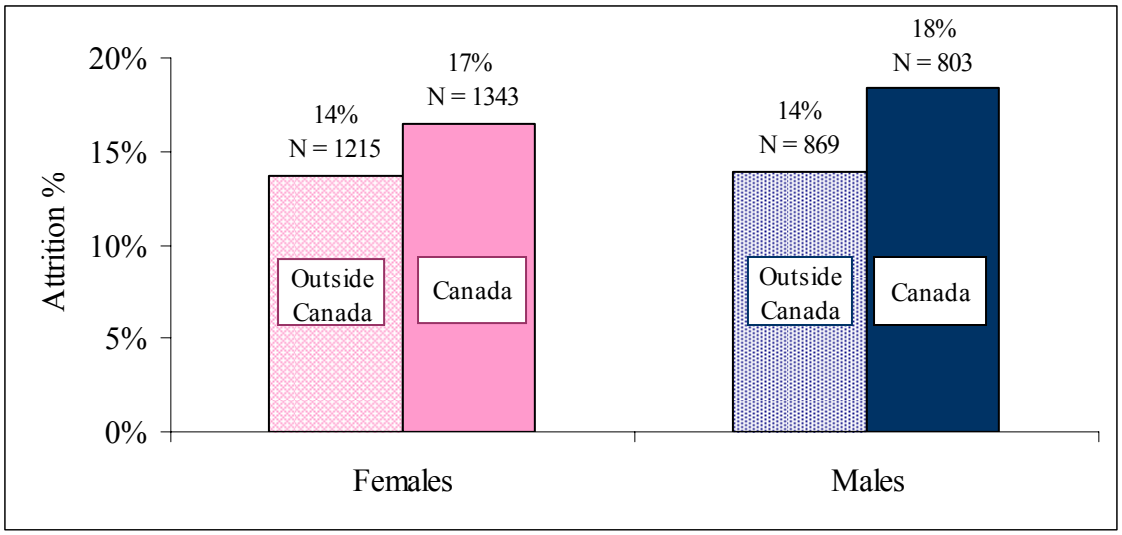
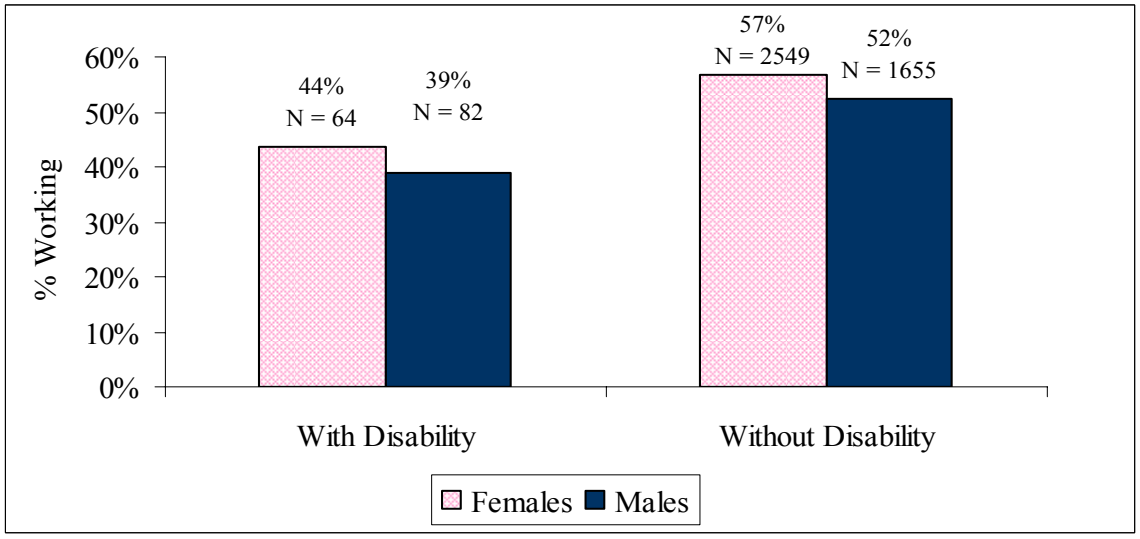


Figure 2.18 Percentage of Students Claiming They Would be Working in Paid Employment in the Upcoming Semester by Sex and Disability (N = 4350).



Moreover, the percentage of students with disabilities who claimed they would be in employment (41.1%) was substantially lower than that of students without disabilities (55.1%) ($\chi 2$ (1, N = 4350) = 11.11, p < .01), and this was true for both males and females (Females: ($\chi 2$ (1, N = 2613) = 4.30, p = .04; Males: $\chi 2$ (1, N = 1737) = 5.63, p = .02).

When only students who were planning to work were examined, a univariate ANOVA (2 Sex X 2 Disability) revealed no significant differences in the average numbers of hours students planned to work during the semester (Table 2.36). On average, students planned to work approximately 15 hours a week regardless of disability or sex.

Table 2.36 Anticipated Average Hours of Paid Employment by Sex And Disability (For Students Reported They Were in Paid Employment.

	Disability	Mean	SD	N
Females	Without Disabilities	14.5	5.3	880
	With Disabilities	15.0	12.3	14
	Total	**14.5**	**5.5**	**894**
Males	Without Disabilities	15.5	6.4	520
	With Disabilities	12.7	4.9	18
	Total	**15.4**	**6.4**	**538**
Total	Without Disabilities	14.9	5.8	1400
	With Disabilities	13.7	8.8	32
	Total	**14.9**	**5.9**	***1432**

**Not all students who claimed they were working reported the hours, so this number is lower than the number students who claimed they would be working.*

The rates of attrition and the hours students claimed they would be working in the upcoming semester are shown in Figure 2.19. Since only 49 students with disabilities provided information for this variable, and of these 38 claimed they would be working for 15 hours or less per week, it was not possible to undertake a detailed breakdown of attrition by hours of employment for this group. These students were included with the non-disabled students for this analysis. From Figure 2.19 it can be seen that up to about 15 hours per week the attrition rates were below, or around the base rates for both males and females. For the 38 students with disabilities this was also the case. However, above 15 hours per week the attrition rates increased, with an especially steep rise for males. Chi square analyses showed that the differences in both female attrition ($\chi 2$ (4, N = 1353) = 20.05, $p < .01$) and male attrition ($\chi 2$ (4, N = 819) = 24.46, $p < .01$) by expected hours worked were significant, with those claiming they would be working more than 15 hours per week dropping out at higher rates. For students claiming they would be in paid employment under 15 hours per week, there was no significant difference between male and female attrition. The male attrition rate (27.4%) for students working more than 15 hours per week was significantly higher than the female rate (21.5%) ($\chi 2$ (1, N = 746) = 4.34, $p < .05$).

2.4.10 Anticipated Time Spent Studying at College

A higher proportion of males (73.7%) than females (65.0%) claimed they would be spending less than 15 hours per week on out-of-class study in the upcoming semester. There was no significant difference in the proportion of students with (68.8%) and without (68.5%) disabilities claiming they would be studying less than 15 hours per week.

Figure 2.19 Hours of Expected Employment and Rate of Attrition by Sex (Students With and Without Disabilities Combined) *(Females: N=2212; Males N = 1476).*

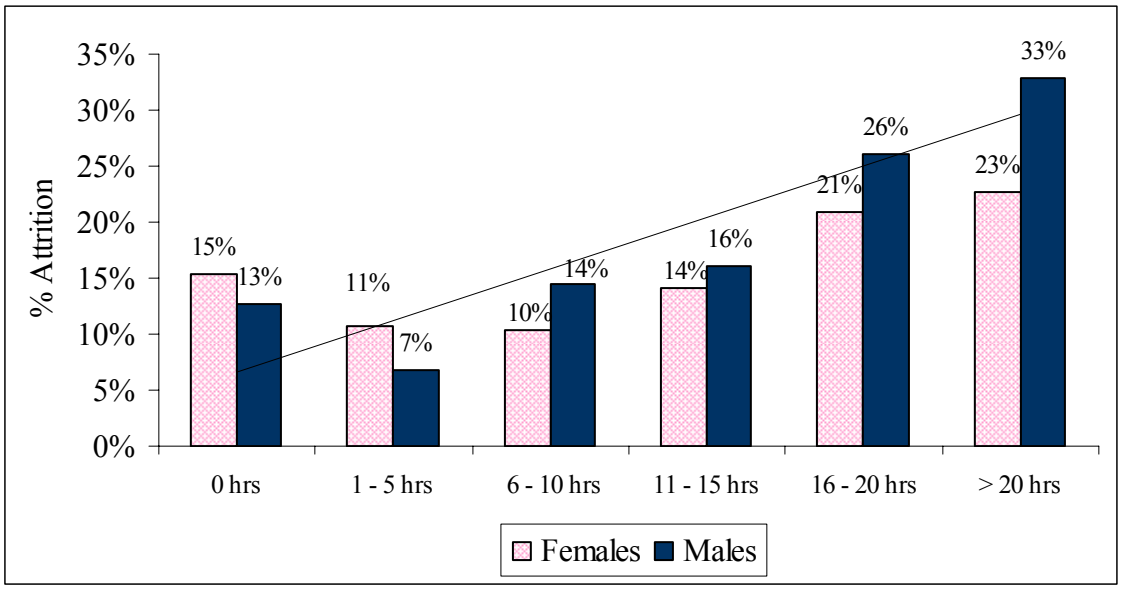


Figure 2.20 shows that students who claimed they would spend less than 15 hours per week on out-of-class study at college in the upcoming semester had higher rates of attrition. Despite the consistent pattern of higher attrition rates, only the difference in attrition rate for females without disabilities was significant ($\chi 2$ (1, N = 2447) = 4.83, p = .03).

2.4.11 Out-of-Class Study Time in Last Year of Study

Approximately the same percentage of students with (25.1%) and without (27.5%) disabilities claimed they spent twelve hours or more per week on out-of-class study in their last year of study. This difference was not statistically significant. However, there was a significantly lower proportion of males than females who claimed they spent 12 or more hours on out-of-class study, and this was true for both students with ($\chi 2$ (1, N = 142) = 10.13, p < .01) and without disabilities ($\chi 2$ (1, N = 4124) = 90.24, p < .01). Only 17% of males claimed they spent twelve or more hours on out-of-class study compared to 30% - 41% of females (see 2.21).

Figure 2.20 Attrition Rate and Anticipated Time Spent on College Study in the Upcoming Semester *(Females No Disabilities: N = 2447; Males No Disabilities: N = 1592; Females With Disabilities: N = 62 Males With Disabilities: N = 79)***.**

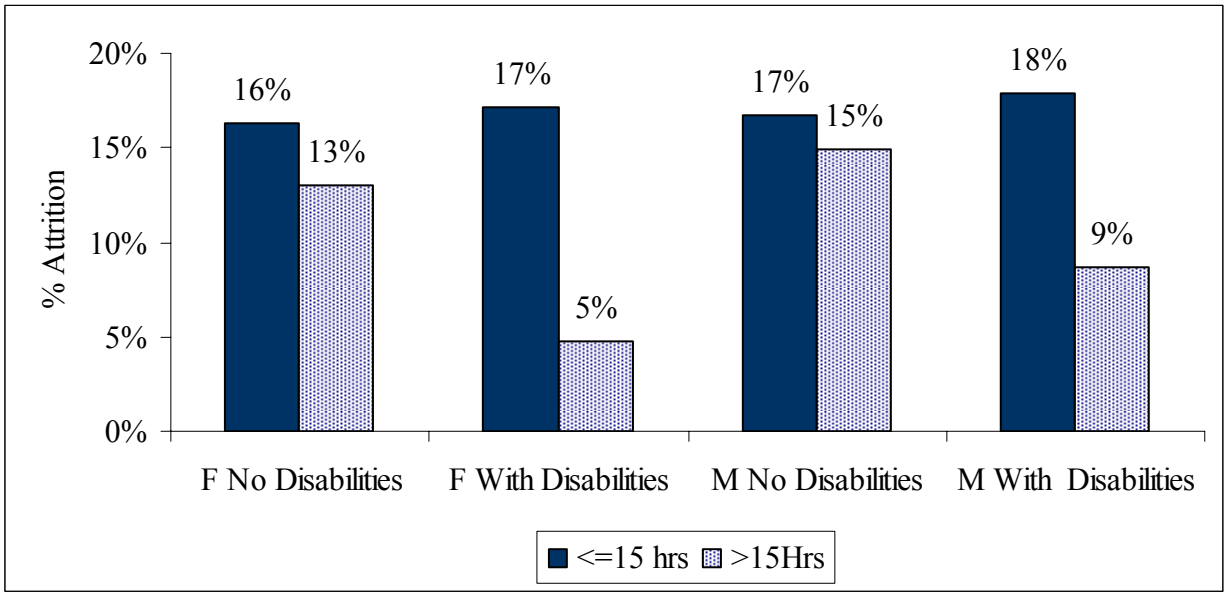
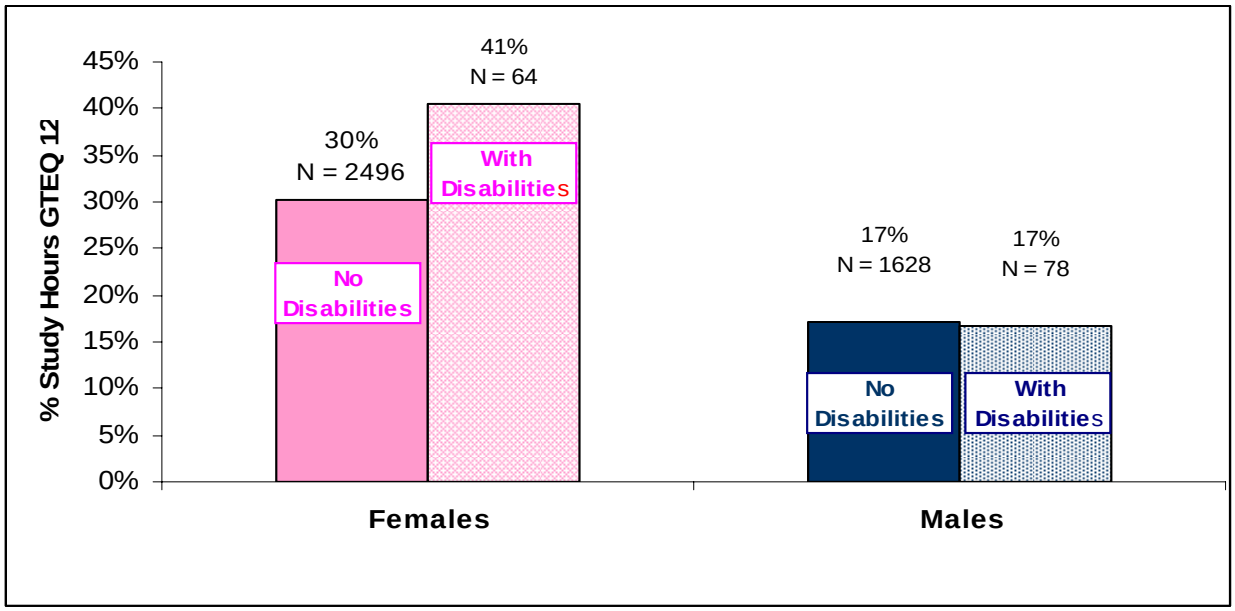


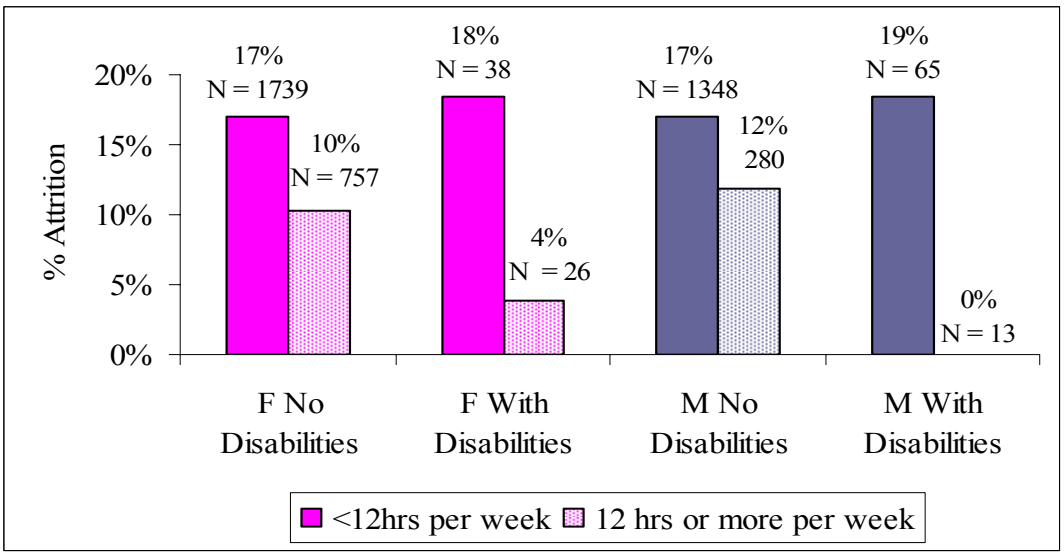
Figure 2.21 Proportion of Students Spending Twelve or More Hours on Out-of-Class Study in Their Last Year.



2.4.12 Out-of-Class Study and Attrition by the Third Semester

Students who claimed they studied for less than 12 hours per week in their last year of study had higher attrition rates than those who claimed they spent 12 or more hours on this activity. This was true for both females ($\chi 2$ (1, 2560) = 20.46, $p < .01$) and males ($\chi 2$ (1, 1760) = 6.04 , $p = .01$) and for students with ($\chi 2$ (1, 142) = 5.90, $p = .02$) and without ($\chi 2$ (1, 4124) = 23.43 , $p < .01$) disabilities. The breakdown by sex and disability is shown in Figure 2.22.

Figure 2.22 Out-of-Class Study Hours During Last Year of Study and Rate of Attrition by the Third Semester by Sex and Disability (F = Females; M = Males).



Only one of the thirty-nine students (2.6%) with disabilities who claimed they spent more than 12 hours per week on out-of-class study had dropped out by the beginning of the third semester. The average difference in attrition rate across all groups was 6.6% higher for those who claimed they spent less than 12 hours per week on study. There was no significant difference between students with and without disabilities.

2.4.13 Difference in Third Semester Attrition Rate by Level of Variable

Students Without Disabilities

The outcomes of the chi square analysis of differences in attrition by level of variable for males and females without disabilities are summarized in Table 2.37, and for students with disabilities in Table 2.38. If there were three levels of the variable (as was the case for diploma type and

language) the differences shown are between the variable level with the highest rate of attrition and the average for all levels. The comparison also includes the Records variables we analyzed earlier. The details of the chi square tests are also shown in the tables. From Table 2.37 it can be seen that, for students without disabilities, all the variables tested using chi square comparisons, with the exception of the country of birth of mothers, had a statistically significant difference for either males or females or both groups. The largest differences in attrition rate for variables common to both males and females without disabilities were related to high school average, age and anticipated hours of employment in the upcoming semester. However, females who were not in their first choice program had an attrition rate that was 10.4% higher than those who were, a factor that was not significant for males. Males, on the other hand, who aspired to a diploma or Bachelor's degree had an attrition rate that was 10.8% higher than those who aspired to a Master's or PhD. This factor was not significant for females.

Students With Disabilities

The common variables for males and females with disabilities that had significant differences in attrition were high school average and age. Although out-of-class study time was not significant for either males or females, it was significant when both groups were combined (Table 2.38). There was a 15.9% difference in attrition rate between those who did and those who did not spend more than 12 hours on out-of-class study, a differential that was higher than for the age (9.9%) and high school average (8.6%) variables (Appendix 12). Median family income and English placement level were significant for females with disabilities but not for males. On the other hand, country of birth of mothers was significant for males but not females. For all students with disabilities, the chi square comparisons showed three variables to be significant: age, high school average and study time in the last year. Five variables were significant for females and four for males if we include the time spent in study variable, which only approached significance ($p < .10$) when the sample was split into males and females. A summary of the variables that were significant by sex for students with and without disabilities is shown in Table 2.39.

Table 2.37 Summary of Differences in 3rd Semester Attrition Rate by Level of Variable – Males and Females Without Disabilities.

(The difference (Diff) in the attrition (Att) rate is between the lowest and highest values of the binary variables. As Language and Diploma type had 3 levels the difference is between the level of variable indicated, and the average of all three levels).

		Females					Males				
Group	**Variable**	**N**	**Diff in Att Rate**	**X^2**	**df**	**p**	**N**	**Diff in Att Rate**	**X^2**	**df**	**p**
Sig for both M & F	*High School Average < 75	18323	16.0%	735.71	1	0.00	14066	21.6%	840.30	1	0.00
	*Age > 17 first time at college	22140	17.9%	781.12	1	0.00	17446	20.2%	782.76	1	0.00
	Paid Employment > 15 hrs/week	1330	9.3%	19.04	1	0.00	793	12.5%	18.72	1	0.00
	Motivation – Low or Average	2602	6.5%	6.25	1	0.01	1685	8.3%	8.01	1	0.00
	*Language was French (3 levels)	22140	3.5%	49.16	2	0.00	17446	2.9%	10.27	2	0.01
	*Diploma Type - A&T (3 levels)	22140	1.3%	6.49	2	0.04	17446	2.7%	18.51	2	0.00
	Country of Birth Father – in Canada	2558	2.8%	3.84	1	0.05	1672	4.5%	6.28	1	0.01
	*English Placement Level - Low	19806	2.9%	21.72	1	0.00	14922	5.0%	44.83	1	0.00
	Study Time Last Yr <12 hours/week	2496	6.7%	18.40	1	0.00	1628	5.2%	4.65	1	0.03
	*Median Family Income (PC) <$60000	21824	4.9%	74.61	1	0.00	17277	5.7%	67.96	1	0.00
F Only	Anticipated College Study Time <= 15 hrs	2447	3.3%	4.83	1	0.03	1592	1.8%	0.74	1	0.39
	*Country of Birth – outside of Canada	22139	3.2%	19.9	1	0.00	17446	1.2%	2.1	1	0.15
	Student was not in First Choice program	2599	10.4%	22.97	1	0.00	1685	2.9%	1.44	1	0.23
M Only	Degree Aspirations were Diploma or Bachelor	1752	3.0%	2.71	1	0.10	1068	10.8%	21.5	1	0.00
	Student was First Generation College Student	2484	1.4%	0.51	1	0.47	1620	5.3%	3.93	1	0.05
Sig for neither M or F	Place of Birth Mother - Canada	2579	1.8%	1.51	1	0.22	1676	3.0%	2.81	1	0.09

**Variable was derived from students' records and, therefore, the N sizes are larger than for survey variables.*

Table 2.38 Summary of Differences in 3rd Semester Attrition Rate by Level of Variable (Using Chi Square Analysis) – Males and Females With Disabilities. *(The difference (Diff) in the attrition (Att) rate is between the lowest and highest rates for binary variables. As Language and Diploma type had 3 levels, the difference is between the level of variable indicated, and the average rate of all three levels).*

		Females					Males				
Group	**Variable**	**N**	**Diff in Att Rate**	**ChiSq**	**df**	**p**	**N**	**Diff in Att Rate**	**ChiSq**	**df**	**p**
Sig for F & M	Age > 17 started college for the first time	570	9.3%	9.52	1	<.01	526	10.0%	9.30	1	<.01
	High School Average < 75	509	6.4%	4.94	1	.03	409	9.1%	5.4	1	.02
F Only	Median Family Income (Post Code) <$60000	558	6.9%	5.83	1	.02	521	0.0%	0.00	1	1.00
	English Placement Level – Low	522	5.9%	3.85	1	.05	462	1.5%	0.20	1	.66
M Only	Country of Birth Mother – Canada	63	-8.4%	0.92	1	.34	83	16.6%	4.17	1	.04
Sig for Neither M or F	Study Time <12 hours in last yr of study	64	14.6%	3.00	1	.08	78	18.5%	2.84	1	.09
	Language was French (3 Levels)	570	3.9%	1.55	2	.46	526	-5.2%	1.67	2	.43
	Country of Birth Father – in Canada	62	-9.9%	1.34	1	.25	83	10.2%	1.56	1	.21
	Diploma Type - Technical (3 Levels)	570	-4.9%	2.19	2	.34	428	-7.9%	3.65	2	.16
	Anticipated College Study Time <=15 hrs	62	12.3%	1.87	1	.17	79	9.2%	1.06	1	.30
	Country of Birth – outside of Canada	570	6.0%	1.81	1	.18	526	1.8%	0.11	1	.74
	Degree Aspirations were Diploma/Bach	45	5.3%	0.19	1	.67	59	10.0%	0.97	1	.32
Unable to Evaluate	First Generation College Student	64	na	na	na	na	79	na	na	na	na
	Expected hours of paid employment	23	na	na	na	na	26	na	na	na	na
	Motivation	66	na	na	na	na	83	na	na	na	na
	Student was not in First Choice program	81	na	na	na	na	67	na	na	na	na

**Variable was derived from students' records and, therefore, the N sizes are larger than for survey variables.*

Table 2.39 Comparison of Variables Related to 3rd Semester Attrition - Students With and Without Disabilities *(Variables were evaluated using chi square tests).*

Significant For:	**Without Disabilities**	**With Disabilities**
Both Males and Females	*High School Average *Age Paid Employment Motivation *Language *Diploma Type *English Placement Level Study Time Last Year Country of Birth Father *Median Family Income (PC)	*High School Average *Age ++
Females Only	College Study Time *Country of Birth First Choice Program	*Median Family Income (PC) *English Placement Level
Males Only	Level of Studies First Generation College Student	Country of Birth Mother
Not Significant for Either Males or Females	Country of Birth Mother	*Diploma Type ++Study Time Last Year *Language Country of Birth Father College Study Time *Country of Birth
Unable to Evaluate		Paid Employment Motivation First Choice program First Generation College Student

*++ This variable was significant at p < .05 for males and females combined; *Variables were obtained from students' records.*

2.4.14 Variables Entering 3rd Semester Attrition Model – Males and Females Without Disabilities

The nine survey variables (shown in Table 2.27), the high school average, and the six Records variables shown in Table 2.4 (excluding sex and disability, which were selection variables) were entered into a logistic regression model using attrition to the third semester as the dependent variable. The binary versions of the variables were used in the model, with the exception of high school grade. This was entered as a continuous variable. Table 2.40 summarizes the results of the pre-model tests and the variables that entered the regression models for males and females without disabilities. The factor with the heaviest pre-model weight (score) for both males and females was the high school average. Anticipated hours to be worked in the upcoming semester and age were also significant for both males and females. However, the place of birth of fathers, the country of birth of the student and the level of studies to which the student aspired were significant factors for males but not females. On the other hand, out-of-class study time in the last year of study, time anticipated studying at College, motivation, English placement level, language, and whether the student was in her first choice program were significant for females but not males.

The binary logistic regression model was run using the 'Enter' method and a cutoff of .16 to determine the variables that were the strongest predictors of attrition. All Records (6) and ISS (9) variables were tested simultaneously with the high school average (Model 4 shown in Table 2.4). Appendix 19 provides the statistical parameters of the model. Table 2.40 summarizes the variables entering the model.

The high school average and age were entered for both males and females, and were the only variables common to both sexes. For males, level of studies and hours worked had the heaviest pre-model scores after high school average and entered the model for males but not females. In addition, median family income and English placement level were entered for males but not females. For females, motivation and language had the heaviest pre-model weights after high school average and age, and only these four variables entered the model. Thus, it would appear that although there are factors related to third semester attrition that are common for both sexes, some factors appear to be more influential depending on sex.

Table 2.40 Males and Females Without Disabilities 3rd Semester Attrition Model –Showing Variables Entering Model *(6 Records Variables, 9 ISS Variables and High School Average; Using Enter Method and cutoff of .16; Variables common to both sexes are highlighted in bold).*

Pre Model Test	Entered
Females	
Language	Language
Age	**Age**
English Placement Level	
Program Choice	
Motivation	Motivation
College Study Time	
Study Time Last Year	
Paid Employment	
High School Average	**High School Average**
Males	
Age	**Age**
Country of Birth	Country of Birth
Country of Birth Father	
Level of Studies	Level of Studies
Paid Employment	Paid Employment
High School Average	**High School Average**
	Median Family Income
	English Placement Level

2.4.15 Comparing Records and ISS Variables - Modeling Attrition to the 3rd Semester by Sex

Seven logistic regression models were run for males and females without disabilities using combinations of the high school average, six Records variables and the nine ISS variables shown in Table 2.27. Only students without disabilities were modeled using the ISS survey variables due sample adequacy issues described earlier. The models we compared were as follows:

Model 1: High School Average

Model 2: 9 ISS Variables

Model 3: 9 ISS Variables & Records Variables

Model 4: 9 ISS Variables & 6 Records Variables and High School Average

Model 5: 6 Records Variables

Model 6: 6 Records Variables & High School Average

Model 7: 9 ISS Variables & 6 Records Variables & High School Average

Table 2.41 Males and Females Without Disabilities - Comparison of Model Sensitivity, Specificity and Precision for 3rd Semester Attrition. *(Enter method, Cutoff .16).*

	N	Nagel-kerke	Sensi-tivity	Speci-ficity	% False Positive	Accuracy	PPV Precision	AUC	Rate Model
Females Without Disabilities									
Model 1 (HS Average)	2242	.051	53.6%	70.3%	29.7%	67.9%	22.8%	.640	Poor
Model 2 (9 ISS Variables)	1207	.048	38.3%	78.9%	21.1%	73.4%	21.9%	.630	Poor
Model 3 (9 ISS Variables & 6 Records Variables)	1207	.090	51.6%	76.0%	24.0%	72.7%	24.9%	.677	Poor
Model 4 (9 ISS Variables & 6 Records Variables & HS Average)	1206	.108	52.8%	75.8%	24.2%	72.7%	25.1%	.687	Poor
Model 5 (6 Records Variables)	2438	.038	35.1%	79.3%	20.8%	73.2%	21.6%	.614	Poor
Model 6 (6 Records Variables & HS Average)	2438	.074	51.2%	74.2%	25.8%	71.0%	24.4%	.664	Poor
Model 7 (9 ISS & HS Average)	1207	.076	48.8%	72.7%	27.3%	69.5%	21.7%	.659	Poor
Males Without Disabilities									
Model 1 (High School Average)	1575	.081	68.0%	61.1%	38.9%	62.2%	24.8%	.684	Poor
Model 2 (9 ISS Variables)	747	.100	55.2%	74.0%	26.0%	71.4%	25.8%	.694	Poor
Model 3 (9 ISS Variables & 6 Records Variables)	747	.160	60.2%	75.9%	24.1%	73.8%	28.7%	.740	Fair
Model 4 (9 ISS Variables & 6 Records Variables & High School Average	743	.194	60.2%	76.1%	23.9%	73.9%	28.8%	.761	Fair
Model 5 (6 Records Variables)	1569	.052	38.3%	81.2%	18.9%	74.4%	27.6%	.618	Poor
Model 6 (6 Records Variables & HS Average)	1569	.107	68.5%	66.8%	33.2%	67.0%	28.0%	.703	Fair
Model 7 (9 ISS & HS Average)	747	.137	58.1%	74.1%	25.9%	71.9%	26.9%	.720	Fair

Because ISS variables were only collected from 2004 onward, the model comparisons were based on the students who entered the college as Cohort A students during this period. Sample sizes for Records variables will, therefore, be lower than those reported in earlier sections where data from students' records dating from 1990 onwards were used to model third semester attrition. The sensitivity, specificity, precision and AUC's of the seven models are compared by sex in Table 2.41.

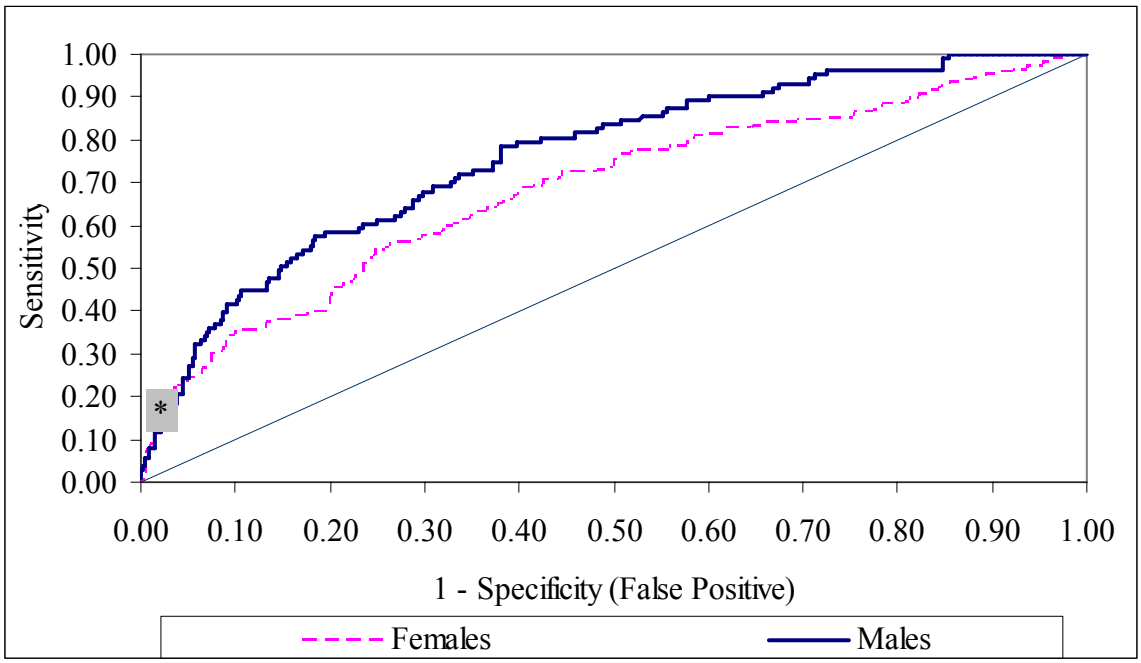
A number of things become evident when we examine Table 2.41. Adding both the Records variables and the ISS variables to the high school average (Model 4) results in improved precision, AUC and Nagelkerke R^2 over that which was achieved using the high school average alone. For males, the combined variable model including the high school average (Model 4) had an overall area under the ROC curve that was significantly higher (by .078) than that of Model 1 (High School Average) ($z = 2.72$ $p = .01$). This AUC was the highest of the seven models we tested, and was rated as fair. However, the difference in the AUC's (.046) between Model 1 and Model 4 was not significant for females.

Model 6, which combined the ISS variables and Records variables, had model characteristics that were an improvement on the high school average. The difference in the AUC's for the two models for males (5.6%) closely approached significance ($z = 1.95$, $p = .05$). The difference of 3.6% for females was not significant. Adding the high school average (Model 4) did not result in a significant improvement in the AUC. Consequently, in the absence of information on the high school average the use of the Records and ISS survey values combined can be used to produce an outcome somewhat better than the high school average.

For each model, the areas under the ROC curves generated from the male models exceeded those of the female models, indicating a better ability of the male models to discriminate between those students who dropped out and those who did not. However, despite the consistent pattern, only Model 4 showed a statistically significant difference between sexes ($z = 2.05$, $p = .04$). The difference in the AUC's between sexes for Model 4 is shown in Figure 2.23.

Another thing evident from Table 2.41 is that at the cutoff chosen (.16) the precision of the third semester models is low.

Figure 2.23 Model 4 - ROC Curve for Attrition to the 3rd Semester by Sex (Students Without Disabilities) *(Enter Method; Females (N = 1206; Males (N = 743); * Cutoff = .35).*

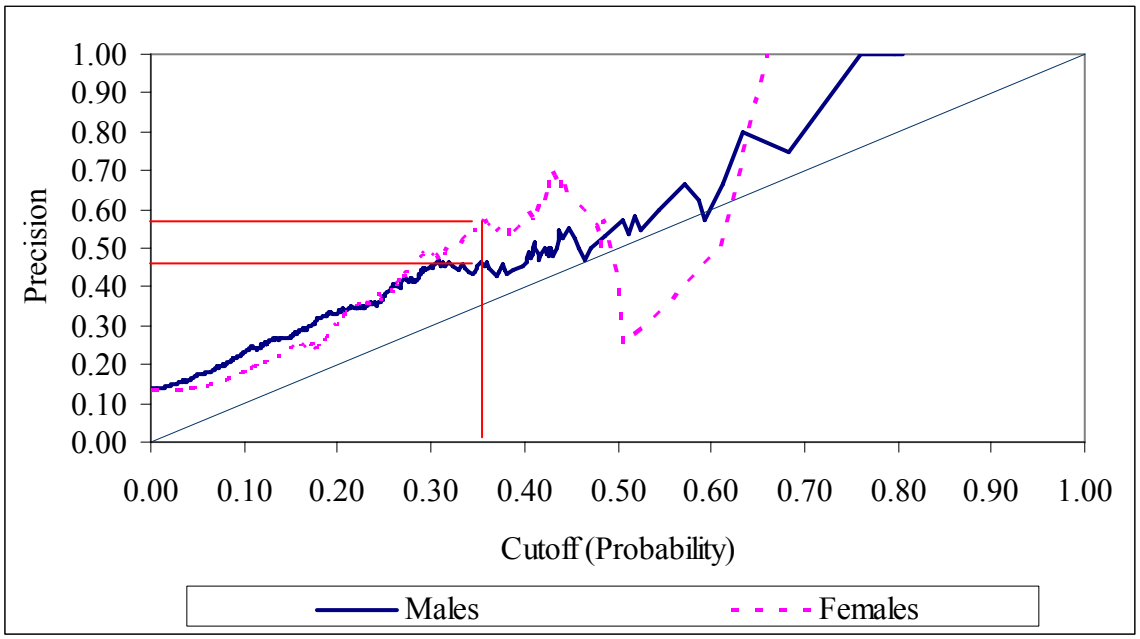


If a sample is chosen from students who were assigned a probability >.16, only about 1 in 5 would be correctly classified. Although the male models shown in the table tended to have higher precision, the models were only compared at one cutoff (.16). If we examine the precision across a range of cutoffs, it can be seen that at increased cutoffs the precision of Model 4 for females is, in fact, higher than that of males (Figure 2.24). Again, by increasing the cutoff, the precision can be improved up to a limit imposed by the characteristics of the model.

Figure 2.24 shows the precision of Model 4 for males and females at a cutoff of .35. As can be seen from Figure 2.24, the male and female lines overlap near this cutoff and the area of the ROC curve where this occurs is highlighted in Figure 2.23. For females the precision at this cutoff is 54.5% (there were 12 false positives and 16 true positives), but the sensitivity was only 14.9%. The higher precision is achieved due to the smaller false positive rate (1.9%).

The precision for males at the cutoff of .35 was 46.3% (there were 19 true positives and 22 false positives). The precision is lower than that of females, and occurs at a sensitivity of approximately 18.4% and a false positive rate of 3.4%. Consequently, by changing the cutoff it is possible to improve the precision of the sample selected for intervention.

Figure 2.24. Precision of Model 4, 3rd Semester Attrition, by Sex.



However, at higher probabilities the number of students is reduced, and the precision of the curve breaks down. The maximum precision that could be achieved before this happens in this sample is around the .35 - .40 cutoff. If a sample was taken from students with a model assigned probability > .35, roughly half might be expected to have dropped out and the other half retained regardless of any intervention. In addition, the total sample with a probability > .35 would be only N = 69 students. However, by adjusting the cutoff, the proportion of students that are likely to receive interventions that may have been unnecessary can be estimated and, therefore, allow better decisions to be made in light of the costs involved.

2.4.16 Summary – 3rd Semester Attrition Comparing ISS and Records Variables

Age and high school average had the largest differences in 3rd semester attrition rates by level of variable for males and females without disabilities. They were also significant for students with disabilities. Time spent on out-of-class study in the last year of study was also significant for both students with and without disabilities. For students without disabilities, the difference in attrition rate was between 5% - 7% higher for students who claimed they spent less than 12 hours on out-of-class study. The difference in attrition rate for students with disabilities was around 16%.

Students aged 18 and over, when commencing their college studies for the first time, had attrition rates that were significantly higher than those commencing at under 18 years of age. For

males and females with disabilities the attrition rate was between 9% and 10% higher. For students without disabilities, the attrition rate for those starting at age 18 and over was between 18% and 20% higher. Historically, a larger proportion of students with disabilities commenced college for the first time at age 18 and over (With Disabilities: 36% vs Without Disabilities: 28%). The proportion of students starting college for the first time who were aged 18 or over was higher for males than for females for both students with and without disabilities, with the proportions for males being particularly high (Males With Disabilities: 40% vs Females With Disabilities: 33%; Males Without Disabilities: 32% vs Females Without Disabilities: 24%).

Students entering their studies with high school averages below 75% had attrition rates that were significantly higher than those commencing with averages above 75%. For females and males with disabilities the rate was between 6% and 9% higher. For females and males without disabilities. the attrition rates for those starting with averages below 75% were between 16% and 22% higher. A greater proportion of students with disabilities commenced their programs with averages below 75% compared to their non-disabled peers (With Disabilities: 64% vs Without Disabilities: 56%). The proportion was higher for males than for females for both groups, with the proportion being particularly high for males with disabilities (Males With Disabilities: 72%; Males Without Disabilities: 59%). Consequently, in both of these high risk categories, students with disabilities were over-represented.

Although there were variables related to 3rd semester attrition that were common for both sexes, some appear to be more influential depending on sex. One variable that seemed to be more important for males than females was the level of studies to which the student aspired. Males who claimed they planned on obtaining a Masters or PhD had attrition rates that were 10% lower than for males who aspired to a college diploma or a Bachelor's degree. The variable was not significant for females. On the other hand, females who were not in their first choice program had attrition rates that were 11% above those who were in their first choice program. For males this difference was not significant. Country of birth and anticipated college study time in the upcoming semester were also significant for females and not males. First generation college student status was significant for males and not females.

The following held true for the models we tested:

- Compared to 3rd semester models, 10th semester attrition models had increased precision, Nagelkerke R^2 values and areas under the ROC curves. This was true of both males and females with and without disabilities. The strength of the association of the independent variables was stronger for 10th semester attrition models and they were better able to discriminate between drop out and attrition.

- 10th semester attrition models (which used Records variables only) had higher areas under the ROC curves, precisions and Nagelkerke R^2 values for males compared to females over most of the cutoff ranges. This was true for students with and without disabilities. Male models, therefore, showed a greater strength of association between attrition and the independent variables we tested, and a greater ability to discriminate between students likely to drop out and those likely to be retained.

- Compared to students without disabilities, models of 10th semester attrition for students with disabilities had lower AUC's and lower precision and Nagelkerke R^2 values over most of the cutoff range. Models of attrition for students with disabilities, therefore, showed a weaker association between attrition and the independent variables that we tested, and were less able to discriminate between students likely to drop out and those likely to be retained.

- By manipulating the cutoffs, it was possible to increase precision of 10th semester attrition models to levels that had practical value (e.g., classifying 7 out of 10 students in a new sample correctly). However, at higher cutoffs the sample size is reduced, and may fall below practical levels for the issue being addressed. This will be especially true with smaller samples.

- By manipulating the cutoff it was possible to raise the precision of 3rd semester models for students without disabilities to levels that had practical value, but this was not the case for students with disabilities. Due to the lower sample sizes, the models tended to break down at a precision of around 20% - 25%, allowing only roughly 1 in 4 students in a new sample to be classified correctly.

- Generally, both 3rd and 10th semester models rated only poor to fair in their ability to discriminate between those who dropped out and those who were retained, as determined by comparisons of areas under the ROC curves.

- Generally, high school average was the heaviest weighted variable. However, a combination of Records Variables and the ISS Survey Variables had better metrics than the high school average alone. A combination of all variables produced the best outcome. The costs of implementing the more complex model needs to be weighed against the benefits gained from the improved precision.

2.5 First Semester Academic Performance

2.5.1 Methodology – Academic Performance

The first semester performance sample for the part of the analysis related to the Records variables included all students who had a high school average, and were awarded a CRC score in their first semester of study between 1992 and 2006. The CRC score (cote de rendement au collégiale), a weighted grade average, was used as the academic performance variable. Although the CRC has a theoretical range of between 0 and 50, in practice, averages tend to range between 15 and 40. The sample consisted of 653 students with and 18406 students without disabilities (Table 2.42).

Table 2.42 Sample Characteristics - First Semester Performance.

	Sex	Without Disabilities	With Disabilities	Total
Records Variables	Females	10732	342	11074
	Males	7674	311	7985
	Total	18406	653	19059
ISS Variables	Females	2368	61	2429
	Males	1519	77	2596
	Total	3887	138	4025

For the analysis related to variables obtained from the Incoming Student Survey (ISS) the sample size was much smaller, as the survey was first administered in 2004, and not all students replied. The ISS sample is a subset of the Records sample. To allow us to compare the academic performance and attrition models based on the same metrics, we used the CRC score as a binary variable. The cutoff chosen was a CRC of 25. This was near to the average score of students who entered university, and gave a sample size that met the sampling adequacy criteria for most of the analyses.

As we were interested in targeting students at risk of weaker performance, we coded CRC scores that were < 25 as 1 (the variable of interest) and CRC scores >= 25 were coded as 0. The number and percentage of students falling above and below the cutoff, by sex and disability, are shown in Table 2.43.

One of the most notable features of the distribution of CRC scores is the high proportion of males with CRC scores below the cutoff of 25, especially males with disabilities (Males, No Disabilities = 61%; Males, With Disabilities = 74.3%). In addition, when only the ISS sub-sample is considered, a larger proportion of the CRC scores for those students who responded to the ISS fell at or above the cutoff compared to non-responders. This was true for both males and females with and without disabilities. In other words, students who responded to the ISS tended to have, on average, higher CRC scores, and lower rates of attrition. This highlights one of the drawbacks of using survey data for modeling, as the characteristics of students who reply to surveys, and on which the model is based, may differ in character from the total population of interest, even when the response rates are quite high (in this case 63%). The difference of 1.45 in CRC scores between survey responders and non-responders was statistically significant ($t(4528.59) = 9.79$, $p < .001$).

Table 2.43 Mean CRC Scores and Percentage of Students with CRC Scores Above and Below the Cutoff of 25.

	Sex		CRC >=25	CRC <25	Total	Mean CRC	SD
Records Variables							
No Disabilities	F	N	5632	5100	10732	24.73	5.52
		%	52.5%	47.5%	100%		
	M	N	2991	4683	7674	22.86	6.00
		%	39.0%	61.0%	100%		
	Total	N	8623	9783	18406	23.95	5.80
		%	46.8%	53.2%	100%		
With Disabilities	F	N	146	196	342	23.71	5.14
		%	42.7%	57.3%	100		
	M	N	80	231	311	21.22	5.56
		%	25.7%	74.3%	100%		
	Total	N	226	427	653	22.52	5.48
		%	34.6%	65.4%	100%		
Incoming Student Survey (ISS) Survey Responders (2004 - 2006)							
No Disabilities	F	N	1455	913	2368	26.01	5.02
		%	61.4%	38.6%	100%		
	M	N	766	753	1519	24.52	5.75
		%	50.4%	49.6%	100%		
	Total	N	2221	1666	3887	25.43	5.37
		%	57.1%	42.9%	100%		
With Disabilities	F	N	33	28	61	24.85	5.20
		%	54.1%	45.9%	100%		
	M	N	31	46	77	23.60	5.12
		%	40.3%	59.7%	100%		
	Total	N	64	74	138	24.15	5.17
		%	46.4%	53.6%	100%		
Incoming Student Survey (ISS) – Non Responders (2004 - 2006)							
No Disabilities	F	N	709	588	1297	24.86	5.60
		%	54.7%	45.3%	100%		
	M	N	361	569	930	22.80	5.89
		%	38.8%	61.2%	100%		
	Total	N	1070	1157	2227	24.00	5.81
		%	48.0%	52.0%	100		
With Disabilities	F	N	24	28	52	24.16	5.51
		%	46.2%	53.8%	100%		
	M	N	8	33	41	20.58	5.37
		%	19.5%	80.5%	100		
	Total	N	32	61	93	22.58	5.71
		%	34.4%	65.6%	100%		
Incoming Student Survey (ISS) – All Students (2004 - 2006)							
All Students	Responder	N	2285	1740	4025	25.39	5.37
		%	56.8%	43.2%	100		
	Non-Responder	N	1102	1218	2320	23.94	5.81
		%	47.5%	52.5%	100%		
	Total	N	3387	2958	6345	24.86	5.58
		%	53.4%	46.6%	100%		

2.5.2 First Semester CRC's – Students With and Without Disabilities

The high school average and other Records variables shown in Table 2.4 (excluding sex and disability, which were selection variables), as well as the nine Incoming Student Survey (ISS) variables shown in Table 2.27 were used to determine which, if any, were related to first term academic performance, as measured by the CRC, for males and females with and without disabilities.

Students Without Disabilities – Comparison of CRC Scores by Level of Variable

Independent t-tests or ANOVAs were used to do the initial comparison of mean CRC scores by levels of the independent variables. For students without disabilities, the mean CRC scores by levels of the variables and the differences between levels are shown in Table 2.44. As can be seen from the table, the tests on all the variables were significant, with the exception of language and the country of birth of students and parents. Moreover, the variables that were significant for females were also those that were significant for males. Details of the standard deviations, t-test (or ANOVA) values and associated probabilities can be found in Appendix 13. As was the case with differences in attrition, the high school average had the largest difference between levels of the dependent variable, in this case the CRC scores. The differences in CRC scores for those with high school averages under and over 75% were 6.34 points for males and 5.89 for females, respectively. A summary of the variables that had significant t-tests for both males and females without disabilities are compared in Table 2.45.

Students With Disabilities – Comparison of CRC Scores by Level of Variable

For females with disabilities, the high school average and English placement results were significant on the t-test comparisons (Table 2.46). For males with disabilities, in addition to these two variables age, out-of-class study, anticipated time studying at college and mother's country of birth were significant. As was the case for students without disabilities, the largest difference in CRC score was related to the high school average. The differences in CRC scores for those with high school averages under and over 75% were 5.78 points for males and 4.87 points for females, respectively. The details of the sample sizes, standard deviations, t-test values and associated probabilities can be found in Appendix 14. Table 2.45 compares the variables that had significant t-tests (or ANOVA) for both males and females with and without disabilities.

Table 2.44 Difference in First Semester CRC Scores by Level of Variable - Males and Females Without Disabilities *(Items highlighted (*) were statistically significant using independent t-tests).*

	Females			Males		
Variables	**0**	**1**	**diff**	**0**	**1**	**diff**
High School Average (0: Under 75%; 1: 75% & Over	20.98	26.87	-5.89*	19.7	26.06	-6.34*
Age (0 : >17; 1 : <=17)	22.29	25.19	-2.90*	20.2	23.51	-3.24*
Program Choice (0: 2nd or Higher; 1: First Choice)	23.19	26.37	-3.18*	21.6	25.08	-3.41*
English placement Level (0: Low; 1: High)	23.47	25.52	-2.05*	21.3	23.87	-2.49*
Anticipated Hours of Employment (0: <=15 hr; 1: > 15 hr)	26.34	24.21	2.13*	25.0	21.99	3.09*
Diploma Type (0: Careers; 1: Pre-University)	23.54	25.01	-2.47*	22.2	23.11	-0.83*
Level of Studies (0: Diploma/Bachelor; 1: Masters/PhD)	25.33	26.66	-1.32*	23.3	25.46	-2.15*
Motivation (0: Lower; 1: Higher)	23.83	26.20	-2.38*	22.5	24.75	-2.20*
Study Time Last Year (0: <12; 1: >=12)	25.36	27.81	-2.45*	24.1	26.62	-2.45*
Median Family Income (0 : Below 60,000; 1 : Above 60,000)	24.10	25.47	-1.37*	22.2	23.54	-1.29*
Country of Birth (Mother) (0: Outside Canada; 1: In Canada)	25.83	26.13	0.30	24.6	24.45	0.16
First Generation(0: Not First Generation; 1: First Generation)	26.30	25.10	1.20*	24.8	23.25	1.55*
Country of Birth (0: Outside Canada; 1: In Canada)	24.59	24.75	-0.16	22.8	22.87	-0.04
Country of Birth Father (0: Outside Canada; 1: In Canada)	25.80	26.19	-0.39	24.4	24.59	-0.19
College Study Time (0: <=15 1: >15)	25.65	26.76	-1.11*	24.2	25.52	-1.31*
+Language (0: French, 1: English, 2: Other)	*	*	*	*	*	*

+ANOVA (2 Sex X 3 Languages) showed no significant differences among the three languages for either females (French: 24.60; English: 24.82; Other Language: 24.57) or males (French: 22.83; English: 22.96; Other Language: 22.61).

Table 2.45 Significant Variables Related to First Semester CRC Scores – Students With and Without Disabilities *(based on independent t-tests).*

Sig for:	Without Disabilities	With Disabilities
Males and Females	Motivation Median Family Income (Post Code) Diploma Type Age English placement Level Program Choice Level of Studies College Study Time Study Time Last Year Paid Employment *First Generation College Student High School Average	English placement Level *N/A High School Average
Females Only	None	None
Males Only	None	Age Country of Birth - Mother College Study Time Study Time Last Year
Neither Males nor Females	Country of Birth - Student Country of Birth - Mother Country of Birth - Father Language	Country of Birth - Student Country of Birth - Father Language Motivation Median Family Income (Post Code) Diploma Type Age Program Choice Level of Studies Paid Employment

**N/A This variable could not be evaluated for students with disabilities as only 3 students were first generation college students.*

Table 2.46 Difference in First Semester CRC Scores by Level of the Variable - Males and Females With Disabilities *(Items highlighted (*) were statistically significant using independent t-tests).*

	Females			Males		
Variables	**0**	**1**	**Diff (0-1)**	**0**	**1**	**diff (0-1)**
High School Average (0: Under 75; 1: 75 & Over	21.41	26.28	4.87*	19.3	25.1	-5.78*
English Placement (0: Low; 1: High)	22.39	24.72	2.33*	20.3	22.0	-1.69*
Program Choice (0: 2nd or Higher; 1: First Choice)	24.04	24.93	-0.89	20.5	24.1	-3.56
Paid Employment (0: <=15 hr; 1: > 15 hr)	25.07	27.50	-2.44	23.7	21.9	1.72
Diploma Type (0: Careers; 1: Pre-University)	23.82	23.13	0.70	21.0	22.0	-1.01
Level of Studies (0: Diploma/Bachelor; 1: Masters/PhD)	23.76	25.56	-1.80	23.1	23.9	-0.82
Age (0: Over 17; 1: <=17)	22.92	23.95	-1.03	19.4	21.8	-2.38*
Motivation (0: Lower; 1: Higher)	25.73	24.85	0.88	24.3	23.5	0.82
Study Time Last Year (0: <12; 1: >=12)	23.91	26.13	-2.22	22.9	26.6	-3.71*
Median Family Income (0: Below 60,000; 1: Above	23.83	23.62	0.20	21.6	21.0	0.56
Country of Birth (Mother) (0: Outside Canada; 1: In	24.47	25.35	-0.89	22.9	26.6	2.56*
#First Generation College Student(1)	na	24.85	na	na	23.7	na
Country of Birth (0: Outside Canada; 1: In Canada)	24.49	23.64	0.86	20.7	21.2	-0.51
Country of Birth (Father) (0: Outside Canada; 1: In	25.62	24.67	0.95	24.9	22.7	2.20
College Study Time (0: <=15 1: >15)	24.60	25.23	-0.63	22.6	25.5	-2.94*
*Language (0: French, 1: English, 2: Other)	*	*	*	*	*	*

#na: There were only 2 females and 1 male who were first generation college students within the group so analysis was not done.

** ANOVA (2 Sex X 3 Languages showed no significant differences among the three languages for either females (French: 24.13; English: 23.58; Other Language: 24.69) or males (French: 23.72; English: 21.00; Other Language: 22.49).*

2.5.3 Significant Variables Predicting First Semester Academic Performance

The sample size for students with disabilities who responded to the Incoming Student Survey did not permit logistic regression modeling for this set of variables due to sampling adequacy constraints. Consequently three models were tested for students with disabilities (Models 1 – 3) using Records variables and seven models were tested for students without disabilities (Models 1 – 7) using a combination of Records variables and ISS variables. However, for students with disabilities, the Diploma Type, Country of Birth and Language variables had fewer than 60 occurrences for at least one level of the variable and, therefore, did not strictly meet the sampling adequacy criteria. The models compared are described as follows:

Model 1: High School Average Only

Model 2: 6 Records Variables Only

Model 3: High School Average & 6 Records Variables

Model 4: 9 ISS Variables Only

Model 5: High School Average & 9 ISS Variables

Model 6: 6 Records Variables & 9 ISS Variables

Model 7: High School Average & 6 Records Variables & 9 ISS Variables

As the high school average (Model 1) had the highest weight on the logistic regression, and the largest difference in CRC scores on the t-test comparison, it was used as the baseline for comparisons to determine if the prediction accuracy could be improved by the addition of either the Records or ISS variables, or some combination of these. The high school average entered the model for all four groups of students. A summary of the outcomes of the models are shown in Table 2.47.

Model 2 (Records Variables) and Model 3 (Records Variables & High School Grades)

For the initial analysis the six Records variables were entered into a logistic regression model (Model 2). All six variables were entered for males and females without disabilities.

For students with disabilities, English placement was important for both sexes. However, language and age were entered for males only, and diploma type was marginally significant for

females. A summary of the variables entering Model 2, which excludes the high school average, is shown in Table 2.47 (Appendix 15 shows the probabilities and model coefficients).

When the high school average was added to the six Records variables, median family income, language and high school average were significant for both males and females without disabilities, as was the case in the attrition model. Diploma type remained significant for females but was not significant for males. English placement level was entered into both the 3rd and 10th semester attrition models as well as the academic performance model for females only. For both males and females with disabilities, the only variable entering Model 3 was the high school average (Appendix 16 shows the probabilities and model coefficients).

There was some commonality between the variables that contributed to attrition and first semester performance. Age, however, which was heavily weighted in the attrition model when the Records variables were entered with the high school average, was not a significant predictor in the academic performance model, once high school average was included. High school average had the heaviest weight in both the models of attrition and academic performance. Tables 2.48 and Table 2.49 compare Records variables entering the attrition and academic performance models for students with and without disabilities, respectively.

Model 4 (9 ISS Variables), Model 6 (6 Records Variables, 9 ISS Variables) and Model 7 (6 Records Variables, 9 ISS Variables & High School Average)

The Incoming Student Survey sample was much smaller than the sample used to test the Records variables. Because of this limitation, we were only able to test models for students without disabilities using the nine ISS variables. Table 2.50 shows the ISS variables that entered into the logistic regression model when the high school average was excluded (Model 4). When the high school average was included with the ISS variables (Model 5), the only variable that was significant was the high school average, and this was true for both males and females. The variables entering Models 6 and 7 are also shown in Table 2.50.

Table 2.47 Records Variables Entering the First Semester Academic Achievement Logistic Regression Models – Comparing Models 2 and 3 for Students With and Without Disabilities *(Without Disabilities: Females: N = 10596; Males: N = 7557 ; With Disabilities F: N = 336; M: N = 302).*

Group	Model 2 Without Disabilities	Model 2 With Disabilities	Model 3 Without Disabilities	Model 3 With Disabilities
Females Only	None	Diploma Type*	Diploma Type English Placement	None
Males and Females	Median Family Income Language Diploma Type English Placement Age Country of Birth	English Placement	Median Family Income Language HS Average	HS Average
Males Only	None	Age Language		None
Neither Males or Females	None	Median Family Income Country of Birth	Age Country of Birth	Age Country of Birth Median Family Income Language Diploma Type English Placement

**Significance was marginal at p = .05*

Table 2.48 Variables Entering Attrition and Academic Performance Models - Students Without Disabilities (for 6 Records Variables and High School Average)

	3rd Semester Attrition	10th Semester Attrition	Academic Achievement Semester 1
Males and Females	High School	HS Average	HS Average
	Age	Age	
	Language	Language	Language
	Median Family Income (PC)	Median Family Income (PC) Diploma Type	Median Family Income (PC)
Females Only			Diploma Type
	English Placement Level	English Placement Level	English Placement Level
Males Only	Country of Birth	None	None
	Diploma Type		
Not Significant For Males or Females	None	Country of Birth	Country of Birth
			Age

Table 2.49 Variables Entering Attrition and Academic Performance Models - Students With Disabilities (6 Records Variables and High School Average)

Group	3rd Semester	10th Semester	Academic Achievement Semester 1
Females Only	HS Average	Language	None
Males and Females	Diploma Type	HS Average	HS Average
Males Only	Age	None	None

Table 2.50 First Semester Academic Performance - ISS Variables Entering Logistic Regression Models 4 – 7 - Students Without Disabilities (Females N = 1168; Males: N = 721)

Group	Model 4 (ISS)	Model 5 (ISS + HS Avg)	Model 6 (ISS + Records)	Model 7 (ISS + Records + HS Avg)
Males and Females	Program Choice Level of Studies Paid Employment	High School Average	Program Choice Paid Employment Age English Placement Level Language	High School Average
Females Only	Study Time Last Year	None	Study Time Last Year Diploma Type	Language Median Family Income (PC)
Males Only	None	None	None	None
Not Entered for Either Males or Females	Country of Birth Mother Country of Birth Father Motivation First Generation College College Study Time	Country of Birth Mother Country of Birth Father Motivation First Generation College College Study Time Level of Studies Program Choice Paid Employment Study Time Last Year	Country of Birth Mother Country of Birth Father Motivation First Generation College College Study Time Country of Birth Median Family Income (PC) Level of Studies	Country of Birth Mother Country of Birth Father Motivation First Generation College College Study Time Country of Birth Level of Studies Paid Employment Age Program Choice English Placement Level Study Time Last Year Diploma Type

In Model 6, when the Records variables and ISS variables were entered without the high school average, three Records variables (Age, English Placement Level, Language) and two survey variables (Program Choice, Paid Employment) were entered for both males and females. In addition one Records variable (Diploma Type) and one ISS variable (Study Time Last Year) were entered for females only. However, when the high school average was added to the variables in Model 6, only the high school average was significant for males, and the high school average, language and median family income were significant for females.

2.5.4 Students Without Disabilities – Models of Academic Performance

A summary of the performance of the seven academic performance models, based on the same criteria we used in assessing the attrition models, is shown in Table 2.51. The significance of the AUC's for Models 1 – 7, can be found in Appendix 17.

For the Model 2 sample (6 Records variables), the probability of a female without a disability having a CRC below 25 was 47.2%. For males, the probability was 60.7%. Based on a cutoff of .5, the precision of Model 2 (i.e., the percentage of a new sample that would be classified correctly) was 60.9% for females and 67.1% for males. Although Model 2 was an improvement on chance selection, it was rated as 'poor' based on the AUC's and had relatively low effect sizes as measured by the Nagelkerke R^2 (Females: .082; Males: .089).

Model 4 (ISS variables), at the cutoff of .5, produced precisions of 52.8% for females and 65.4% for males. For the students included in this model, the probability of a female without disabilities having a CRC below 25 was 34.6% and for males the probability was 47.2%. The model, therefore, resulted in better than chance selection, but was rated as 'poor' based on the AUC and had relatively low Nagelkerke R^2 values (Females: .075; Males: .132). In the absence of a high school average, these variables could be used to obtain better than chance selection. However, Model 2 (Records) would be best selected as it avoids the problems associated with variables derived from surveys.

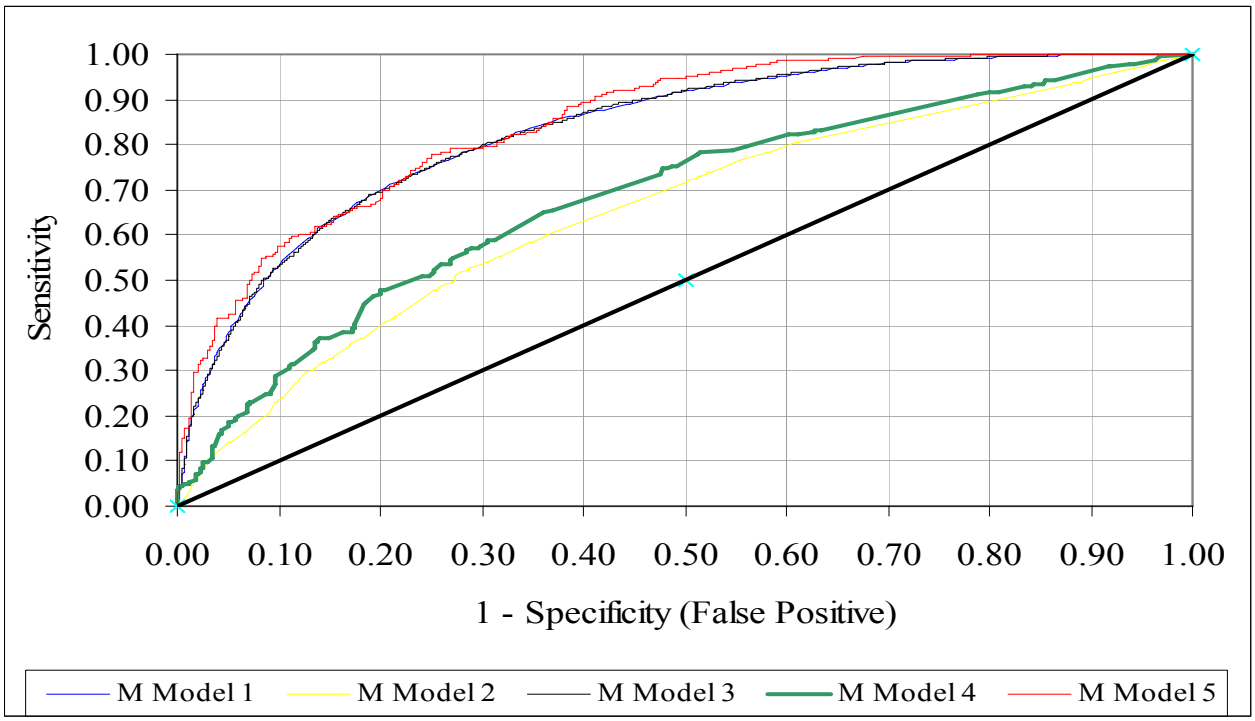
Models 1, 3, 5 and 7 had AUC's ranging between .819 -.850 and were rated as 'good'. The Nagelkerke R^2 also ranged from .377 to .476 for these models. The differences in the AUC's between Model 1 and the remaining three models were not significant.

Table 2.51 Comparison of Seven Models of First Semester Academic Performance – Students Without Disabilities
(Enter Method Cutoff .5).

	N	Nagel-kerke R^2	Sensitivity	Specificity	% False Positive	Accuracy	PPV Precision	AUC	Rate Model
Females Without Disability									
Model 1: HS Average	10732	.415	74.1%	76.3%	23.7%	75.3%	73.9%	.831	Good
Model 2: 6 Records Variables	10596	.082	48.7%	72.1%	27.9%	61.1%	60.9%	.643	Poor
Model 3: HS Average & 6 Records Variables	10596	.420	73.4%	76.9%	23.1%	75.3%	74.0%	.834	Good
Model 4: 9 ISS Variables	1169	.075	16.5%	92.1%	7.9%	66.0%	52.8%	.646	Poor
Model 5: HS Average & 9 ISS Variables)	1169	.377	55.1%	85.3%	14.7%	74.9%	66.6%	.819	Good
Model 6: 6 Records Variables & 9 ISS Variables)	1168	.123	25.7%	90.0%	10.0%	67.7%	57.8%	.680	Poor
Model 7: HS Average & 6 Records Variables & 9 ISS Variables	1168	.391	56.8%	86.5%	13.5%	76.2%	69.1%	.826	Good
Males Without Disability									
Model 1: HS Average	7674	.420	85.5%	62.7%	37.3%	76.6%	78.2%	.834	Good
Model 2: 6 Records Variables	7557	.089	80.4%	39.2%	60.8%	64.2%	67.1%	.653	Poor
Model 3: HS Average & 6 Records Variables	7557	.423	84.6%	63.2%	36.8%	76.2%	78.0%	.835	Good
Model 4: 9 ISS Variables	724	.132	50.9%	75.9%	24.1%	64.1%	65.4%	.685	Poor
Model 5: HS Average & 9 ISS Variables)	724	.473	72.5%	77.5%	22.5%	75.1%	74.3%	.850	Good
Model 6: 6 Records Variables & 9 ISS Variables)	721	.201	58.2%	75.1%	24.9%	67.1%	67.6%	.732	Fair
Model 7: HS Average & 6 Records Variables & 9 ISS Variables	721	.476	72.4%	77.7%	22.3%	75.2%	74.3%	.851	Good

There is, therefore, little to be gained by adding the Records variables to the high school average (Model 3). Adding the ISS variables (Model 5) or both the Records and ISS variables to (Model 7) also did not improve the predictive value or the AUC's. There were no significant differences in the areas under the ROC curves between either Model 1 and 5 or Model 1 and 7. This can be seen in Figure 2.25, which shows the overlapping of the curves associated with Models 1 and 5.

Figure 2.25 Comparison of ROC Curves For Five Models of Academic Performance *(Using data for males without disabilities).*



From the graph it can be seen that Models 1, 3 and 5 overlap, and are virtually indistinguishable. Model 2 (six Records variables alone) and Model 4 (ISS variables) were poor predictors of first semester performance, although it should be noted that their precisions were comparable to those obtained for the10th semester attrition models. The only model where there was a significant difference between males and females in the AUC's was for Model 6, which entered the 6 Records and 9 ISS variables, but excluded the high school average ($z = 2.09$, $p = .04$). In the absence of the high school average, the Records and ISS variables were better able to discriminate CRC's under and over 25 for males than for females.

The high school average (Model 1) had a Nagelkerke R^2 of 0.42 for both sexes. Figure 2.26, plots the precision against the cutoff for students without disabilities. Over the range of cutoffs the precision of the male model is higher. However, it is possible to improve the precision by raising the cutoff. Using a cutoff of 0.90 would result in a PPV for females of 91.2% and for males of 94.3%. This would result in a sample size of 1264 males and 678 females based on the sample size used in the study, of which we would expect over 90% to be classified correctly. . The extent to which precision can be improved by raising the cutoff depends on the sample size, and the cutoff at which the model breaks down or fails to provide a sample size large enough to be useful. Since Model 1 (High School Average) was the best predictor, just selecting students with the lowest high school averages for targeted interventions would be the easiest approach.

2.5.5 Students With Disabilities - Models of Academic Performance

The outcomes of the three models tested for students with disabilities are shown in Table 2.52. The equivalent models for students without disabilities are provided for the purposes of comparison. From Table 2.5.2 it can be seen that the precision of Model 1 (High School Average) is the highest, or near to the highest of the models tested. Adding the Records variables to the high school average did little to improve precision, as was the case for students without disabilities. Again by adjusting the cutoffs it was possible to improve the precision. There was no significant difference in the AUC's between Model 1 and Model 3 for either males or females with or without disabilities. Figure 2.26 shows the overlapping ROC curves for males and females with and without disabilities for Model 3.

2.5.6 Summary Academic Performance

Unlike the models of attrition where we found differences in areas under the ROC curves between males and females and students with and without disabilities, this was not the case with the academic performance models we tested. The high school average proved to be the best predictor for all groups and was the only variable to enter the model for males and females with disabilities and males without disabilities.

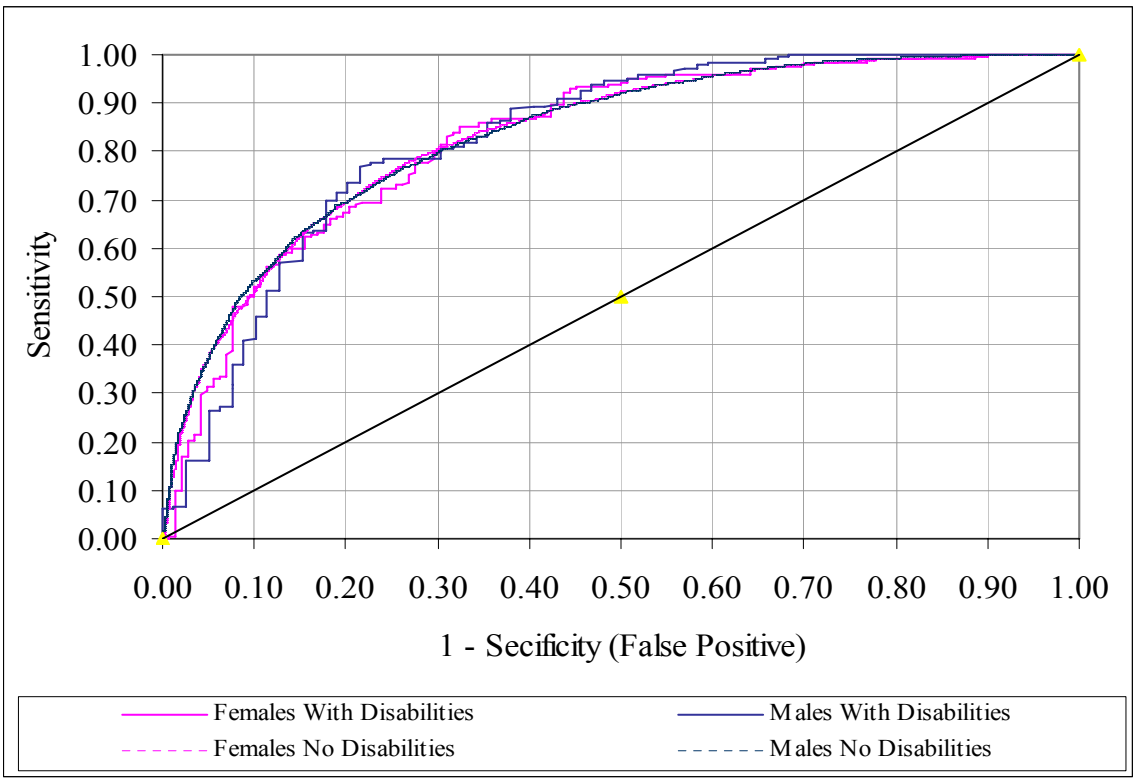
Table 2.5.2 Comparison of Three Models of First Semester Academic Performance – Students With Disabilities.

(Enter Method Cutoff .5; HS = High School; Avg = Average).

	N	Nagel-kerke R^2	Sensitivity	Specificity	% False Positive	Accuracy	PPV Precision	AUC	Rate Model
Females With Disability									
Model 1: High School Average	342	.378	84.7%	63.0%	37.0%	75.4%	75.5%	.823	Good
Model 2: 6 Records Variables	336	.093	64.9%	59.9%	40.1%	62.8%	68.9%	.656	Poor
Model 3: HS Avg & 6 Records	336	.396	85.1%	65.5%	34.5%	76.8%	77.1%	.827	Good
Females Without Disability									
Model 1: High School Average	10732	.415	74.1%	76.3%	23.7%	75.3%	73.9%	.831	Good
Model 2: 6 Records Variables	10596	.082	48.7%	72.1%	27.9%	61.1%	60.9%	.643	Poor
Model 3: HS Avg & 6 Records	10596	.420	73.4%	76.9%	23.1%	75.3%	74.0%	.834	Good
Males With Disability									
Model 1: High School Average	311	.386	93.1%	55.0%	45.0%	83.3%	85.7%	.825	Good
Model 2: 6 Records Variables	302	.121	96.4%	10.1%	89.9%	73.8%	75.2%	.694	Poor
Model 3: HS Avg & 6 Records	302	.404	92.4%	53.2%	46.8%	82.1%	84.8%	.830	Good
Males Without Disability									
Model 1: High School Average	7674	.420	85.5%	62.7%	37.3%	76.6%	78.2%	.834	Good
Model 2: 6 Records Variables	7557	.089	80.4%	39.2%	60.8%	64.2%	67.1%	.653	Poor
Model 3: HS Avg & 6 Records	7557	.423	84.6%	63.2%	36.8%	76.2%	78.0%	.835	Good

Although other variables besides the high school average entered the model for females without disabilities, these variables did not improve the metrics of the models we tested. Unlike the attrition models, the areas under the AUC's derived from the first semester academic performance models overlapped for males and females with and without disabilities, indicating that the model was equally able to discriminate between low and high achievement for all groups.

Figure 2.26 First Semester Academic Performance ROC Curves Comparing Males and Females With and Without Disabilities *(Model 3: High School Average & 6 Records Variables).*



The models for academic performance that included the high school average were rated as 'good' compared to the models of attrition that rated either as 'poor' or 'fair', and lends support to our hypothesis that the high school average would be the strongest predictor of both academic performance and attrition, but would be a better predictor of academic performance.

2.6 Psychosocial and Study Skill Variables – The Student Readiness Inventory (SRI)

2.6.1 Student Readiness Inventory Sample Description

Psychosocial variables were collected using the ACT Student Readiness Inventory (SRI). This data set was not a subset of the master file, but was collected using data from the survey which was administered by mail in the Autumn session of 2007. There were 434 valid responses received from Cohort A college students (Females: N = 294; Males: N = 140). Of these, 37 students had a disability (Females: N = 25; Males: N = 12). Each student's enrolment status was checked in the autumn session of 2008 (the third semester), and the rate of attrition to the third semester was calculated. For this sample there were no significant differences in the attrition rate between students with and without disabilities, or between males and females. The attrition rates averaged 11.1%, (This compared to an overall average rate of approximately 17% for the autumn 2007 cohort. A substantially higher percentage of students with disabilities (64.9%) had CRC scores <25 compared to students without disabilities (31.5%). Of the 12 males with disabilities with a CRC recorded, none had a CRC above 25. The proportion of males with CRC scores under 25 (43.6%) exceeded that of females (29.9%). Details concerning both the attrition rates and CRC scores can be found in Appendix 18.

2.6.2 Psychosocial Profiles by Sex

Mean scores on the ten SRI scales were compared for males and females without disabilities using multivariate analysis of variance (MANOVA (Table 2.53). Table 2.53 shows that males scored lower than females on six of the ten SRI scales. These were the Commitment to College, Academic Discipline, General Determination, Study Skills, Communication Skills and Social Connection scales. There were no significant differences between males and females for students with disabilities.

2.6.3 Psychosocial Profiles by Disability

Thirty-seven students with disabilities replied to the survey. Of these, 20 were registered with the college's Services for Students with Disabilities and 17 self-reported their disability. The differences in mean scores between students with and without disabilities by scale are shown in Table 2.54. Students with Disabilities scored significantly lower on 6 of the 10 scales, with

differences ranging from 2.09 – 5.15 across the ten scales. The largest difference between the two groups was on the Academic Self Confidence Scale (5.15) followed by the Social Connection scale (3.40).

Table 2.53 Comparison of the Difference in Mean Scale Scores by Sex - Students Without Disabilities *(Females N = 269; Males = 128. Difference (Diff) is Females – Males)*

	Females		Males		MANOVA			
Scale	M	SD	M	SD	Diff	F	Sig	df
Commitment to College	55.69	5.48	53.73	6.98	1.96	9.29	0.00	1
Goal Striving	51.33	6.76	50.53	6.04	0.13	0.04	0.84	1
Academic Discipline	51.28	6.74	47.13	7.46	4.21\	31.36	0.00	1
General Determination	58.91	5.52	56.86	5.76	2.05	11.61	0.00	1
Study Skills	54.49	9.42	52.05	9.42	2.44	5.82	0.02	1
Communication Skills	52.11	5.27	49.44	6.47	2.67	19.15	0.00	1
Social Activity	43.16	9.02	42.17	9.81	0.98	0.98	0.32	1
Social Connection	50.25	8.58	49.45	8.66	2.48	7.22	0.01	1
Academic Self Confidence	54.98	8.77	55.84	9.14	-0.86	0.82	0.37	1
Steadiness	50.13	9.90	49.66	9.72	0.46	0.19	0.66	1

Table 2.54 Comparison of the Difference in Mean Scale Scores by Disability *(Without Disabilities: N = 397; With Disabilities: N = 37; Difference is between students without disabilities - students with disabilities).*

	No Disabilities		**With Disabilities**		**MANOVA**			
Scale	Mean	SD	Mean	SD	Diff	F	Sig	df
Commitment to College	55.06	6.07	52.60	9.75	2.46	4.93	0.03	1
Goal Striving	50.67	6.20	47.38	8.17	3.29	8.97	0.00	1
Academic Discipline	49.97	7.26	47.62	8.30	2.35	3.47	0.06	1
General Determination	58.25	5.67	54.97	9.13	3.27	9.96	0.00	1
Study Skills	53.71	9.48	51.11	11.03	2.60	2.47	0.12	1
Communication Skills	51.25	5.81	48.62	6.24	2.63	6.82	0.01	1
Social Activity	42.84	9.28	39.67	9.65	2.87	3.20	0.07	1
Social Connection	49.45	8.66	46.05	8.73	3.40	5.21	0.02	1
Academic Self Confidence	55.26	8.89	50.11	10.46	5.15	11.01	0.00	1
Steadiness	49.98	9.83	47.89	11.30	2.09	1.48	0.22	1

2.6.4 SRI Scale Variables and Attrition

Since only 48 of the 434 students had dropped out by the third semester, the sampling adequacy requirement was not met for logistic regression. However, we conducted a preliminary logistic

regression analysis. Three of the scale variables entered the model: Academic Discipline, Social Control, and Social Activity. These three variables are considered determinants of retention as reported in the scale descriptions (ACT Testing Services, 2008). However, Commitment to College, described as a strong predictor of attrition, did not enter the model, although it was significant in the pre-model test. The precision of the model was 26.9% at a cutoff .16, the same cutoff we used in our third semester models described earlier. The area under the ROC curve was .72, and rated as fair. These values are similar to those we obtained using the Records variables and High School Average Models (Table 2.22) for third semester retention. We will continue to monitor these variables as predictors as this cohort of students progresses through their college studies.

2.6.5 SRI Scale Variables and First Semester Academic Performance

The CRC score was used as the dependent variable for the comparisons of academic performance. A correlation analysis was undertaken to determine the strength of the relationship between the ten SRI scale variables and the average first semester CRC score. For students without disabilities, four of the scales were found to have statistically significant correlations with the CRC: Academic Discipline, Commitment to College, General Determination and Academic Self Confidence, with Academic Discipline having the strongest correlation (r = .328). For students with disabilities there were no significant correlations between the scale variables and CRC scores. For males without disabilities, Social Activity and Social Connection had a negative correlation with the CRC score. Correlation coefficients for the scale variables that were significant are shown in Table 2.55.

The differences in scale means between students who obtained a CRC < 25 and those who obtained a CRC >= 25 are shown in Table 2.56. One of the largest differences between the two groups was on the Academic Discipline scale. Students with a CRC score >= 25 scored significantly higher on the scale (Difference: Females: 4.02; Males: 3.62).

Table 2.55 Correlations Between CRC Scores and SRI Scales for Students Without Disabilities

Scale	N	Pearson Correlation	Sig
All Students Without Disabilities			
Commitment to College	393	0.118	.019
Academic Discipline	393	0.328	.000
General Determination	393	0.120	.017
Academic Self-Confidence	393	0.169	.001
Females			
Academic Discipline	265	0.324	.000
General Determination	265	0.134	.029
Academic Self Confidence	265	0.206	.001
Males			
Commitment to College	128	0.285	.001
Social Activity	128	-0.187	.035
Social Connection	128	-0.196	.027

Table 2.56 Difference in Mean SRI Scale Scores by Level of CRC – Students Without Disabilities

(The difference (Diff) is between those with higher CRC's and those with lower CRC's)

	CRC >= 25			CRC < 25			F Test			
	N	M	SD	N	M	SD	Diff	F	Sig.	df
Females										
Commitment to College	193	56.03	5.33	76	54.83	5.80	1.20	2.64	0.11	1
Goal Striving	193	51.18	5.57	76	49.53	7.74	1.65	3.79	0.05	1
Academic Discipline	193	52.40	6.06	76	48.62	7.67	3.78	18.14	0.00	1
General Determination	193	59.23	5.05	76	58.09	6.52	1.14	2.32	0.13	1
Study Skills	193	54.59	9.06	76	54.26	10.35	0.32	0.06	0.80	1
Communication Skills	193	52.26	5.12	76	51.71	5.65	0.55	0.60	0.44	1
Social Activity	193	43.11	9.10	76	43.26	8.87	-0.15	0.01	0.90	1
Social Connection	193	50.74	8.23	76	49.01	9.35	1.73	2.22	0.14	1
Academic Self Confidence	193	56.01	8.42	76	52.38	9.16	3.62	9.60	0.00	1
Steadiness	193	50.13	9.36	76	50.12	11.22	0.01	0.00	0.99	1
Males										
Commitment to College	79	54.72	6.12	49	52.12	7.99	2.60	4.30	0.04	1
Goal Striving	79	49.86	6.09	49	51.73	5.83	-1.87	2.96	0.09	1
Academic Discipline	79	48.53	6.21	49	44.86	8.73	3.67	7.72	0.01	1
General Determination	79	56.66	5.39	49	57.18	6.36	-0.53	0.25	0.62	1
Study Skills	79	51.51	8.53	49	52.94	10.72	-1.43	0.70	0.40	1
Communication Skills	79	49.30	5.75	49	49.65	7.54	-0.35	0.09	0.77	1
Social Activity	79	40.41	9.88	49	45.02	9.10	-4.62	7.01	0.01	1
Social Connection	79	46.51	8.88	49	49.82	7.87	-3.31	4.57	0.03	1
Academic Self Confidence	79	56.62	8.68	49	54.59	9.79	2.03	1.50	0.22	1
Steadiness	79	50.03	9.01	49	49.08	10.85	0.94	0.28	0.60	1
All Students – No Disability										
Commitment to College	272	55.65	5.59	125	53.77	6.84	1.88	8.89	0.00	1
Goal Striving	272	50.79	5.75	125	50.39	7.11	0.40	0.55	0.46	1
Academic Discipline	272	51.28	6.34	125	47.14	8.27	4.13	31.95	0.00	1
General Determination	272	58.48	5.27	125	57.74	6.45	0.75	1.84	0.17	1
Study Skills	272	53.69	9.00	125	53.74	10.47	-0.05	0.03	0.86	1
Communication Skills	272	51.40	5.47	125	50.90	6.51	0.50	0.82	0.36	1
Social Activity	272	42.33	9.40	125	43.95	8.96	-1.62	2.39	0.12	1
Social Connection	272	49.51	8.63	125	49.33	8.78	0.18	0.12	0.72	1
Academic Self Confidence	272	56.18	8.49	125	53.25	9.44	2.94	10.23	0.00	1
Steadiness	272	50.10	9.24	125	49.71	11.04	0.39	0.28	0.595	1

2.6.6 Logistic Regression Analysis – SRI Variables and Academic Performance

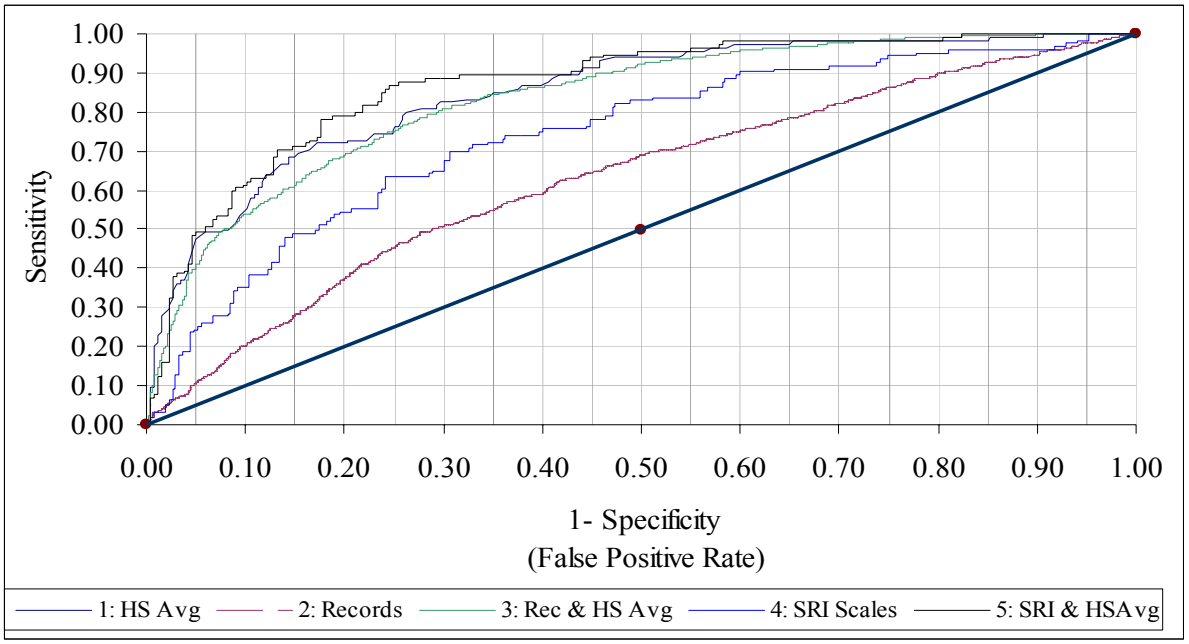
The Records variables Diploma Type, Language, Country of Birth and English Placement Level violated the sampling adequacy criteria for categorical variables, as there were fewer than 10 events per model parameter for the smaller class of dependent variable. Therefore, to compare models based on these variables we used the 2006 cohort.

Five models comparing the Records variables (Diploma Type, Language, Age, Country of Birth, Median Family Income, English Placement Level) the SRI scales and High School Average were tested and compared on the same metrics we used in our earlier attrition analyses. The results are shown in Table 2.57. Figure 2.27 plots the ROC curves for each of the models. Based on the AUC's, Model 4 (SRI scales) performed better than Model 2 (Records variables) ($z = 3.81$ $p < .01$), but neither performed better than Model 1 (High School Average). Moreover, neither the Records variables nor SRI scale variables, when added to the high school average, produced significant gains in the ability to discriminate between those with high and low CRC scores. There were no significant differences between the AUC's for either Model 1 and 3 or 1 and 5.

Table 2.57 Comparison of SRI Scale Variables and Records Variables in Predicting High (>= 25) or Low (< 25) CRC Scores for Students Without Disabilities.

	Model Description	N	Nagel-kerke R^2	Sensitivity	Specificity	% False Positive	Accuracy	PPV Precision	AUC	Rate Model
Model 1	HS Average	380	0.425	58.8%	89.1%	10.9%	80.0%	69.8%	0.850	Good
Model 2	Records Variable	2700	0.069	48.9%	72.5%	27.5%	61.2%	61.8%	0.630	Fair
Model 3	Records Variables & HS Average	2462	0.456	59.8%	91.4%	8.6%	82.1%	74.4%	0.834	Good
Model 4	SRI Scale Variables	393	0.191	29.3%	91.5%	8.5%	72.0%	61.0%	0.740	Fair
Model 5	SRI Scale Variables & HS Average	380	0.470	60.5%	90.2%	9.8%	81.3%	72.6%	0.870	Good

Figure 2.27 Five Models of Academic Performance Comparing High School Average, SRI and Records Variables.



diff

2.6.7 Summary SRI Variables

SRI Variables - Differences by Sex and Disability

We found that students with disabilities scored lower on six of the ten SRI scales. The largest difference was on the Academic Self- Confidence followed by the Social Connection scale. Males scored lower than females on six of the ten SRI scales. The largest differences were on the Academic Discipline and Communication Skills scales.

SRI Variables and Academic Performance

We found no correlation between the SRI scales and CRC scores for students with disabilities, although the small sample size (N = 37) made it difficult to show statistical significance. Using logistic regression modeling, the pre-model test showed that three of the ten SRI variables we tested were significantly related to CRC scores for students without disabilities: Academic Discipline, General Determination and Academic Self-Confidence. When we entered the high school average with the SRI variables into a logistic regression model, Academic Discipline and General Determination remained significant. Although the SRI variables (AUC = .740) were better at discriminating between high or low CRC scores than the Records variables (AUC =

.630), neither were better than the high school average alone (AUC = .850). Moreover, when either the Records or SRI variables were added to the high school average, there was no gain in the ability of the model to discriminate between low and high first semester CRC scores.

The difference in mean scores on the Academic Discipline scale between those with high and low CRC scores was significant for both sexes. However, Goal Striving and Academic Self-Confidence were significant for females but not males. Social Activity and Social Connection were not significant for females, but were significant for males. Males with CRC's below 25 scored higher on both of these scales (ie there was a negative correlation between the two variables as shown earlier). For males Commitment to College was also significant.

Part III
Reasons for Leaving College

3 Background - Reasons For Leaving

One of the objectives of the present study was to identify the reasons why former Dawson students left the college before completing their studies and what they believed could have been done to help them remain. To this end, the Reasons for Leaving Survey included open-ended questions. Here, we report on the findings from the open-ended responses to the Reasons For Leaving question. An analysis of closed ended questions on the survey are not included here as the data were not available at the time this report was written. For the same reason, the open-ended questions do not include the responses of those students who left between the winter of 2007 and the autumn of 2008.

As in our previous analyses, responses were examined separately for the following sub-groups: males versus females and students with versus students without disabilities. In addition, analyses were carried out to compare responses of former Cohort A students with those students who had studied at a cegep before. Responses were examined to test the following four hypotheses:

1. The Reasons for Leaving of males and females will be similar, but their relative importance will differ.
2. The most important Reasons for Leaving given by students with disabilities will be

similar to those of students without disabilities – and not related to their disabilities.

3. The Reasons for Leaving of males and females with disabilities will mirror those of males and females without disabilities, respectively.
4. Cohort A students who leave in the first or second semester of their programs will report different reasons for leaving their college studies compared to those who were not first time cegep students.. .

3.1 Method and Sample Characteristics

The closed ended items on the Reasons for Leaving Survey were based on the ACT Standard Reasons for Leaving Survey (ACT Survey Service, 2007), and on a survey conducted at Curtin University (Elliot, 1997). The instrument included items relating to student and institutional characteristics as well as academic and non-academic factors that have emerged from the research literature, shown to be related to drop out. An open-ended question was also posed asking students to provide the main reason that they felt contributed to their decision to leave. The survey was administered by a first mail-out with one follow-up approximately two weeks later, to those students who did not reply.

At the time of writing of this report, replies were received from the autumn 2006 leavers who failed to return in autumn 2007 (the 2007 survey) and autumn 2007 leavers who failed to return in the winter semester of 2008 (the 2008 survey). Responses made by 283 former students were coded and analyzed. To examine open-ended comments about why students abandoned their studies at the college a Coding Manual (Ferraro, Barile, & Fichten, 2008) was developed, and survey responses were coded.

Participants

Of the 283 students who responded to the survey, 177 responses were received from females and 106 from males. Two hundred and sixteen of the survey responders (132 females and 84 males), reported no disability. Sixty-seven (45 females and 22 males), reported having a disability. Ninety-five students were Cohort A students and, therefore, had no previous experience of studying at a Quebec cegep (Females N = 63; Males N = 32).

Coding of Open-Ended Questions

In developing the categories included in the "Reasons for Leaving College and Recommendations Coding Manual", two researchers read a sample of participant responses to the Reasons for Leaving questions from a questionnaire administered in 2006 (to students who left in 2005), and noted the Reasons for Leaving themes that emerged. The Reasons for Leaving categories were used as a basis for the coding manual. Coding rules, specified in the manual, were agreed upon to ensure consistency throughout the coding process.

The coding manual consists of:

- 30 categories of Reasons for Leaving,
- A set of coding rules.

Reliability of Coding

The reliability of coding was assessed by two trained coders according to the following inter-rater reliability formula: Inter-Rater Agreement (%) = 2 (Number of Coder 1 and Coder 2 Agreements) / (Number of codes recorded by Coder 1 + Number of codes recorded by Coder 2). Inter-rater agreement calculations for the 2007 and 2008 survey data combined are based on a total of 505 Reasons for Leaving coded items. Mean inter-rater agreement was 85% for the Reasons codes. A second measure of inter-rater reliability, Cohen's kappa, was computed to take into account agreement occurring by chance. Kappa coefficient was .72 for Reasons codes and .63 for Recommendations codes. These reliabilities represent substantial agreement between the two raters.

Presentation of Results

The analyses, presented here, consist of: (a) visual presentation of the comparison of the percentage of students who indicated at least one response in the category in graphic form (e.g., males vs females), (b) a series of χ^2 test results examining the proportions of the two groups of participants who provided responses in each category, and (c) Pearson product-moment correlation coefficients examining the relationship between the number of students in the two groups of participants who endorsed each category.

3.2 Females and Males – Cohort A

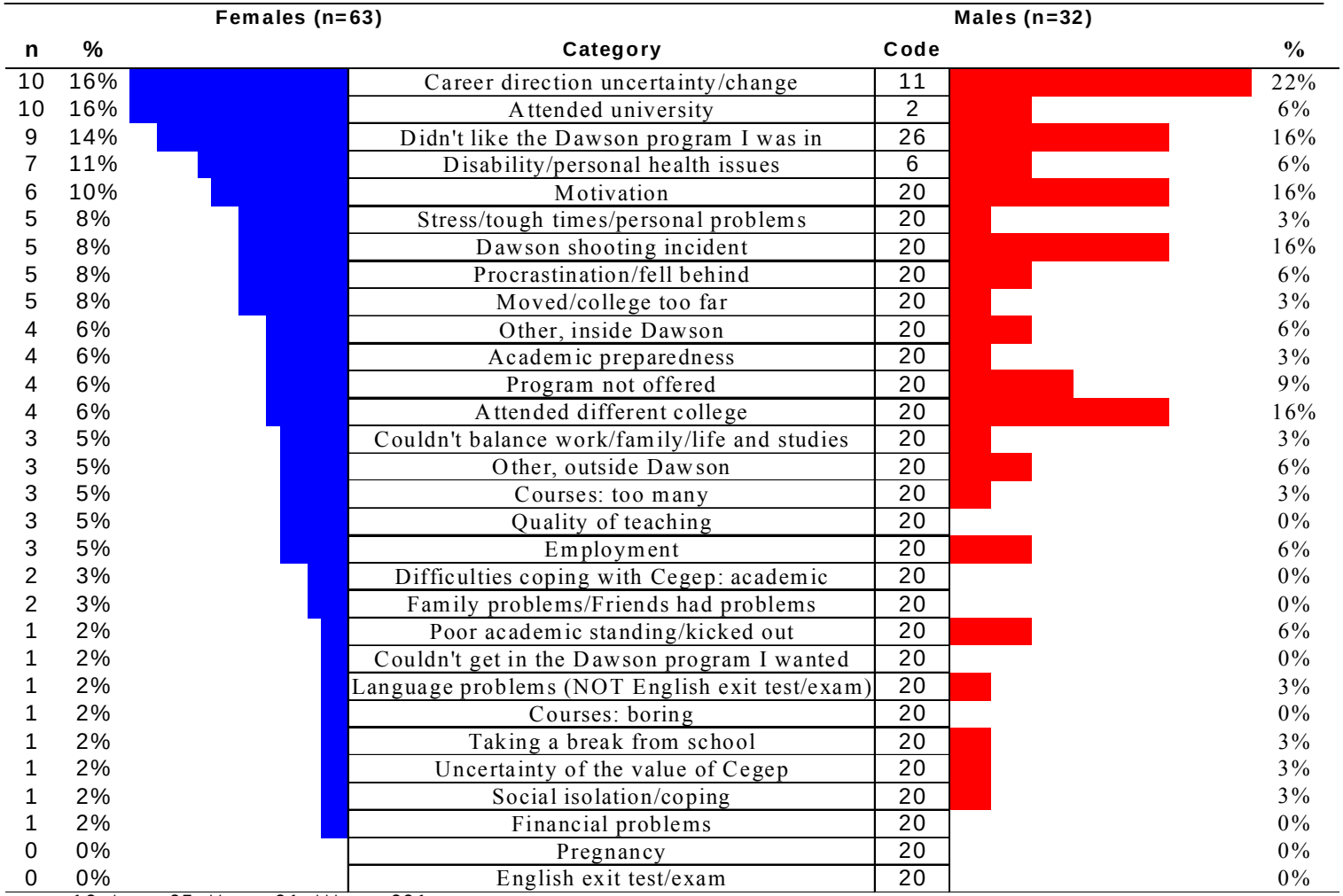
Hypothesis 1 predicted that the Reasons for Leaving for males and females would be similar. To examine how well the data fit this hypothesis, a series of Pearson correlations and χ^2 comparisons were carried out.

Figure 3.1 presents the Reasons for Leaving of female (n = 63) and male (n = 32) Cohort A students. Reasons for Leaving for these two groups was significantly correlated, $r(26) = .682$, $p = .000$. There were no significant differences in the proportion of students who indicated each Reason for Leaving for these two groups. The top five reasons given by females were career change/uncertainty (16%), attended university (16%), didn't like the program they were in (14%), disability/personal health issues (11%) and lack of motivation (10%). The top five reasons for males were career direction/uncertainty (22%), didn't like the program they were in (16%), lack of motivation (16%), attended a different college (16%) and the shooting incident (16%), an unusual event that occurred in September 2006. There was, therefore, some support for our hypothesis that the reasons for leaving for males and females would be similar, as three of the top five reasons were the same for both groups. However, attendance at university and disability/personal health issues did not rank in the top five for males. Attended a different college and the shooting incident did not rank in the top five for females.

3.3 Students With and Without Disabilities – Cohort A

Figure 3.2 compares the reasons for leaving given by Cohort A students with and without disabilities (Without disabilities: N = 75; With disabilities: N = 20). The Reasons for Leaving for these two groups was not significantly correlated, $r(26) = .110$, $p = .578$.

Figure 3.1 Reasons for Leaving – Cohort A students – Males vs Females



Females (n=63)				Males (n=32)	
n	%	Category	Code		%
10	16%	Career direction uncertainty/change	11		22%
10	16%	Attended university	2		6%
9	14%	Didn't like the Dawson program I was in	26		16%
7	11%	Disability/personal health issues	6		6%
6	10%	Motivation	20		16%
5	8%	Stress/tough times/personal problems	20		3%
5	8%	Dawson shooting incident	20		16%
5	8%	Procrastination/fell behind	20		6%
5	8%	Moved/college too far	20		3%
4	6%	Other, inside Dawson	20		6%
4	6%	Academic preparedness	20		3%
4	6%	Program not offered	20		9%
4	6%	Attended different college	20		16%
3	5%	Couldn't balance work/family/life and studies	20		3%
3	5%	Other, outside Dawson	20		6%
3	5%	Courses: too many	20		3%
3	5%	Quality of teaching	20		0%
3	5%	Employment	20		6%
2	3%	Difficulties coping with Cegep: academic	20		0%
2	3%	Family problems/Friends had problems	20		0%
1	2%	Poor academic standing/kicked out	20		6%
1	2%	Couldn't get in the Dawson program I wanted	20		0%
1	2%	Language problems (NOT English exit test/exam)	20		3%
1	2%	Courses: boring	20		0%
1	2%	Taking a break from school	20		3%
1	2%	Uncertainty of the value of Cegep	20		3%
1	2%	Social isolation/coping	20		3%
1	2%	Financial problems	20		0%
0	0%	Pregnancy	20		0%
0	0%	English exit test/exam	20		0%

~p < .10. *p < .05. **p < .01. ***p < .001.

Note. Percentages refer to percent of participants who said this.

Figure 3.2 Reasons for Leaving of Cohort A Students: Without Disabilities vs. Students With Disabilities.

Students without Disabilities (n=75)				Students with Disabilities (n=20)					
n	%	Category	Code	%	n	$X^2(1)$	*p*	*
15	20%	Career direction uncertainty/change	11	10%	2	1.07	0.300	
12	16%	Didn't like the Dawson program I was in	26	10%	2	0.45	0.501	
11	15%	Attended university	2	5%	1	1.34	0.248	
8	11%	Motivation	20	15%	3	0.29	0.590	
7	9%	Attended different college	1	10%	2	0.01	0.928	
7	9%	Procrastination/fell behind	19	0%	0	2.02	0.156	
6	8%	Dawson shooting incident	23	20%	4	2.41	0.120	
6	8%	Moved/college too far	3	0%	0	1.71	0.191	
5	7%	Program not offered	15	10%	2	0.26	0.612	
5	7%	Stress/tough times/personal problems	29	5%	1	0.07	0.785	
5	7%	Employment	5	0%	0	1.41	0.235	
5	7%	Academic preparedness	16	0%	0	1.41	0.235	
4	5%	Other, inside Dawson	21	10%	2	0.58	0.446	
4	5%	Other, outside Dawson	22	5%	1	0.00	0.953	
4	5%	Courses: too many	13	0%	0	1.11	0.291	
4	5%	Couldn't balance work/family/life and studies	27	0%	0	1.11	0.291	
3	4%	Poor academic standing/kicked out	30	0%	0	0.83	0.363	
2	3%	Family problems/Friends had problems	7	0%	0	0.54	0.460	
2	3%	Taking a break from school	10	0%	0	0.54	0.460	
2	3%	Difficulties coping with Cegep: academic	17	0%	0	0.54	0.460	
2	3%	Language problems (NOT English exit test/exam)	18	0%	0	0.54	0.460	
1	1%	Disability/personal health issues	6	40%	8	27.53	0.000	***
1	1%	Quality of teaching	12	10%	2	3.88	0.049	*
1	1%	Social isolation/coping	8	5%	1	1.03	0.310	
1	1%	Uncertainty of the value of Cegep	9	5%	1	1.03	0.310	
1	1%	Courses: boring	14	0%	0	0.27	0.604	
1	1%	Couldn't get in the Dawson program I wanted	25	0%	0	0.27	0.604	
0	0%	Financial problems	4	5%	1	3.79	0.052	~
0	0%	English exit test/exam	24	0%	0			
0	0%	Pregnancy	28	0%	0			

~*p* < .10. *p < .05. **p < .01. ***p < .001.

Note. Percentages refer to percent of participants who said this.

A significantly larger proportion of students with disabilities (40%) than without disabilities (1%) indicated that they left Dawson due to disability/personal health issues, $\chi^2(1, 9) = 27.53$, $p = .000$. The top four reasons for leaving given by students without disabilities were career direction/uncertainty (20%); didn't like the program they were in (16%); attended university (15%) and lack of motivation (11%). Apart from disability/personal health issues, the next most frequent reason given by students with disabilities was the shooting incident (20%) and lack of motivation (15%).

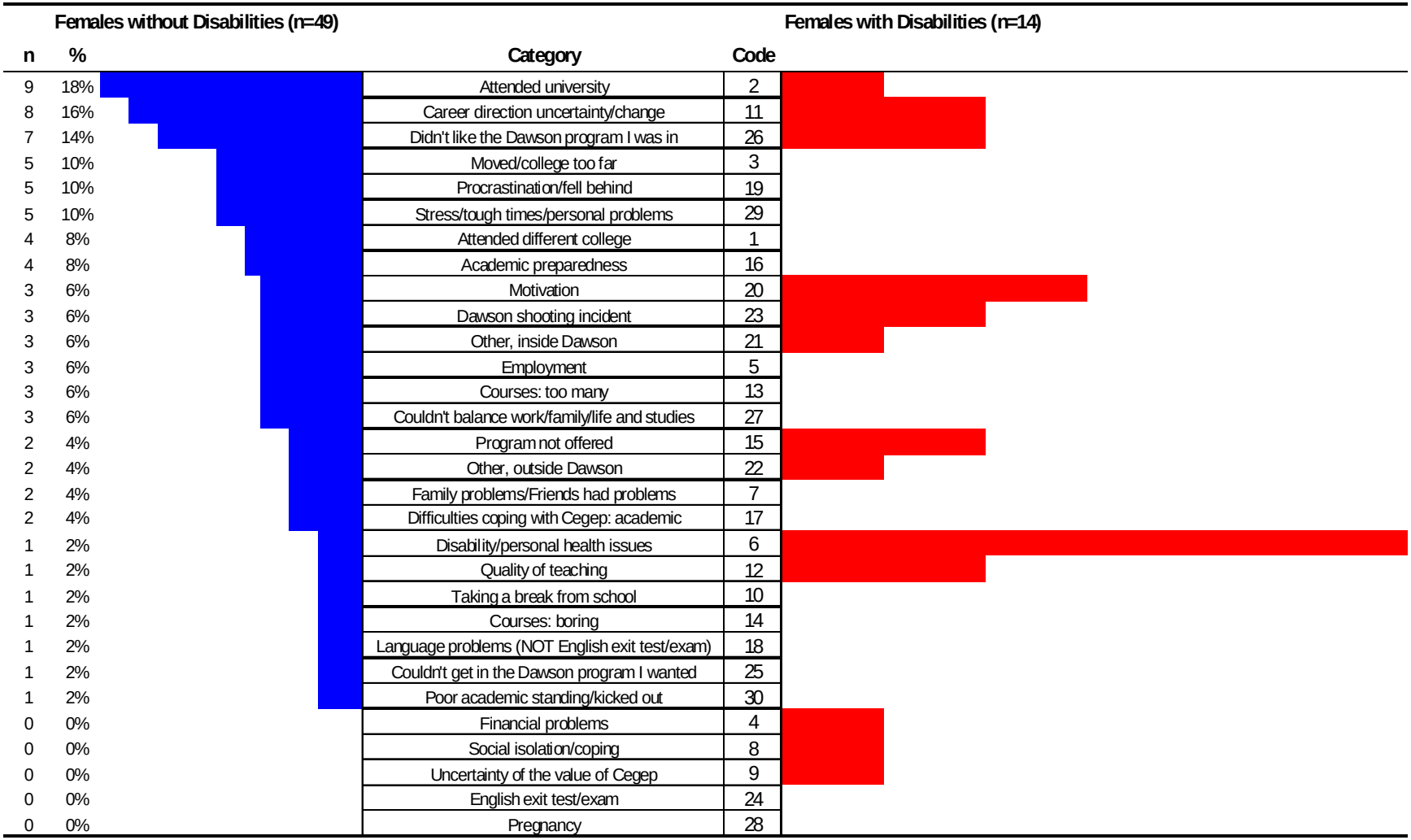
3.4 Females and Males With and Without Disabilities – Cohort A

One of our hypothesis was that the reasons for leaving of male and female students with disabilities would mirror those of males and females without disabilities. The female comparison is shown in Figure 3.3 along with Pearson correlation coefficients and χ^2 test results. Reasons for Leaving for these two groups was not significantly correlated, $r(26) = .005$, $p = .802$. A significantly larger proportion of females with disabilities (43%) than without disabilities (2%) indicated that they left their studies due to disability/personal health issues ($\chi^2(1, 7) = 18.37$, $p = .000$), and this was their main reason for leaving. There were only six replies from Cohort A males so the data are not shown. However, the data for females did not support our hypothesis. The main reason for leaving for females without disabilities was 'attended university'.

3.5 Cohort A Students Compared to Students With Previous Cegep Experience

Figure 3.4 compares the reasons given by Cohort A students who left prior to completing their first year to the reasons given by students with previous cegep experience. Overall, the reasons for leaving for these two groups was significantly correlated, $r(28) = .697$, $p = .000$. Nevertheless, a significantly larger proportion of Cohort A students (18%) than students with previous cegep experience (7%) indicated that they left because they were uncertain of, or had a change in career direction, $\chi^2(1, 31) = 7.06$, $p = .008$, because the program they wanted to get into was not offered at the College (7% and 2%, respectively), $\chi^2(1, 11) = 4.64$, $p = .031$, and because they weren't academically prepared for college (5% and 1%, respectively), $\chi^2(1, 6) = 6.81$, $p = .009$.

Figure 3.3. Reasons for Leaving of Cohort A Females : Without Disabilities vs. With Disabilities.



Females without Disabilities (n=49)		Category	Code	Females with Disabilities (n=14)
n	%			
9	18%	Attended university	2	
8	16%	Career direction uncertainty/change	11	
7	14%	Didn't like the Dawson program I was in	26	
5	10%	Moved/college too far	3	
5	10%	Procrastination/fell behind	19	
5	10%	Stress/tough times/personal problems	29	
4	8%	Attended different college	1	
4	8%	Academic preparedness	16	
3	6%	Motivation	20	
3	6%	Dawson shooting incident	23	
3	6%	Other, inside Dawson	21	
3	6%	Employment	5	
3	6%	Courses: too many	13	
3	6%	Couldn't balance work/family/life and studies	27	
2	4%	Program not offered	15	
2	4%	Other, outside Dawson	22	
2	4%	Family problems/Friends had problems	7	
2	4%	Difficulties coping with Cegep: academic	17	
1	2%	Disability/personal health issues	6	
1	2%	Quality of teaching	12	
1	2%	Taking a break from school	10	
1	2%	Courses: boring	14	
1	2%	Language problems (NOT English exit test/exam)	18	
1	2%	Couldn't get in the Dawson program I wanted	25	
1	2%	Poor academic standing/kicked out	30	
0	0%	Financial problems	4	
0	0%	Social isolation/coping	8	
0	0%	Uncertainty of the value of Cegep	9	
0	0%	English exit test/exam	24	
0	0%	Pregnancy	28	

~$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$.

Note. Percentages refer to percent of participants who said this.

Figure 3.4. Reasons for Leaving Cohort A Students vs. Students with Previous Cegep Experience

Cohort A (n=95)				With previous cegep experience (n=188)				
n	%	Category	Code	%	n	$X^2(1)$	*p*	*
17	18%	Career direction uncertainty/change	11	7%	14	7.06	0.008	**
14	15%	Didn't like the Dawson program I was in	26	12%	23	0.35	0.555	
12	13%	Attended university	2	12%	23	0.01	0.924	
11	12%	Motivation	20	18%	33	1.72	0.190	
10	11%	Dawson shooting incident	23	9%	16	0.31	0.579	
9	9%	Disability/personal health issues	6	12%	22	0.32	0.571	
9	9%	Attended different college	1	10%	18	0.00	0.978	
7	7%	Procrastination/fell behind	19	5%	10	0.47	0.493	
7	7%	Program not offered	15	2%	4	4.64	0.031	*
6	6%	Other, inside Dawson	21	13%	25	3.15	0.076	~
6	6%	Stress/tough times/personal problems	29	10%	18	0.86	0.353	
6	6%	Moved/college too far	3	2%	4	3.25	0.072	~
5	5%	Employment	5	9%	16	0.97	0.325	
5	5%	Other, outside Dawson	22	8%	15	0.71	0.400	
5	5%	Academic preparedness	16	1%	1	6.81	0.009	**
4	4%	Couldn't balance work/family/life and studies	27	6%	12	0.56	0.455	
4	4%	Courses: too many	13	4%	7	0.04	0.841	
3	3%	Poor academic standing/kicked out	30	8%	15	2.46	0.117	
3	3%	Quality of teaching	12	4%	7	0.06	0.808	
2	2%	Family problems/Friends had problems	7	5%	10	1.61	0.205	
2	2%	Taking a break from school	10	5%	9	1.22	0.270	
2	2%	Language problems (NOT English exit test/exam)	18	4%	7	0.54	0.464	
2	2%	Difficulties coping with Cegep: academic	17	3%	5	0.08	0.777	
2	2%	Social isolation/coping	8	2%	3	0.09	0.759	
2	2%	Uncertainty of the value of Cegep	9	1%	2	0.49	0.483	
1	1%	Financial problems	4	3%	5	0.79	0.376	
1	1%	Couldn't get in the Dawson program I wanted	25	2%	3	0.13	0.715	
1	1%	Courses: boring	14	1%	2	0.00	0.993	
0	0%	English exit test/exam	24	3%	5	2.57	0.109	
0	0%	Pregnancy	28	3%	5	2.57	0.109	

~$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$.

Note. Percentages refer to percent of participants who said this.

The results suggest that while Cohort A students and students with college experience had some overlap in reasons they gave for leaving their studies without graduating, there were a few notable differences. Cohort A students were more likely to say they left because of career uncertainty. The top three reasons given by Cohort A students, in order of importance, were career direction change/uncertainty; they did not like the program they were in and to attend university. The top three reasons given by students with previous cegep experience in order of importance were: lack of motivation, other factors inside of Dawson, and equally because they didn't like their program and to attend university.

3.6 Reasons for Leaving Summary

Reponses of male and female students, students with and without disabilities, and Cohort A students vs students who had previously studied at a Quebec cegep were compared. Students with and without disabilities generally had different Reasons for Leaving. The top reason for leaving reported by students with disabilities was related to disability/health issues (40%). Students without disabilities were far less likely to report this (1%). This is consistent with our previous work where students with disabilities reported disability/health as the main factor that made their college studies harder (Fichten, Jorgensen & Havel, 2006).

There was support for our hypothesis that the reasons given by Cohort A students would differ from students who had completed at least one semester of study at cegep. Cohort A students leaving prior to completing their first year were more likely to say they left due to career direction uncertainty/change, or they did not like the program they were in, while the most frequent response category for students with prior cegep experience was low motivation and other factors inside Dawson. There was, also, some support for out hypothesis that the reasons for leaving for males and females would be similar, as three of the top five reasons for leaving were the same for both groups. However, attendance at university and disability/personal health issues did not rank in the top five for males. Attended a different college and the shooting incident did not rank in the top five for females.

Part 1V

Discussion and Recommendations

4.1 Patterns of Attrition

The higher persistence and graduation rates of females in postsecondary education has been extensively documented (e.g. Ma & Frempong, G., 2008; Ministère de l'éducation du Québec, 2001; US Department of Statistics, 2001, Peter & Horn, 2005). We found that both males with and without disabilities dropped out at higher rates than their female counterparts, both between the first and third semester and third and tenth semester. Males who were in pre-university programs were 1.3 times as likely as females to drop out by the tenth semester, and those in career programs 1.2 times as likely to drop out. Ma & Frempong (2008) in their study of reasons for non completion of post-secondary education, reported similar findings, and found that male youths were 1.39 times more likely than female youths to drop out of postsecondary education.

The attrition rates were slightly higher between first and third semester than between the third and tenth semester for students without disabilities. On the other hand, students with disabilities dropped out at substantially higher rates in the later semesters than between the first and third semester. By the tenth semester the attrition rates of students with disabilities had equalized with those of their non-disabled peers, but students with disabilities had a higher percentage of students still enrolled, and thus the opportunity to achieve a higher overall graduation rate.

Our hypothesis that attrition patterns were similar for both students with and without disabilities, therefore, was not supported. This pattern of attrition for students with disabilities may be unique to the college where the study was undertaken, but there are no published works with which to compare our results that we are aware of. However, a number of authors have reported on overall graduation rates. Hudy (2006) in her study of university students, found no difference in the persistence rates (measured by number of semesters completed) of students with disabilities compared to students without disabilities. Vogel & Adelman (1992) found a matched sample of students with learning disabilities had slightly higher graduation rates. On the other hand Horn & Berkold (1999) found students with disabilities were less likely to have earned a postsecondary credential within 5 years.

The low dropout rates in the early semesters may be related to the fact that there are fewer opportunities for students with disabilities in the labor force, and so they remain in higher education for a longer period. The low efficacy of the high school average as a predictor of attrition for students with disabilities in the shorter time frame of three semesters, but not over ten semesters, suggests that the high school average, although related to the departure of students with and without disabilities, did not come into play for students with disabilities until later in their programs. This is consistent with the possibility suggested by Nora, Barlow & Crisp (2005), (although not for students with disabilities specifically), that the focus on the first semester, may have pushed the attrition problem into later semesters. The college's provision of disability services helps students with their adjustment to college, and this may serve to improve retention in the early semesters. However, students may drop out in later semesters, as subject material becomes more difficult. It is not possible from this study to assess the reasons for the different attrition pattern for students with disabilities. However, it is interesting to note that these patterns can vary for different sub-populations. A large proportion of the entering cohorts with disabilities are, therefore, still present to benefit from assistance provided at later stages in their program.

4.2 Male and Female Attrition and Low High School Averages

Our hypotheses that the attrition rate of males with high school averages below 80% would be higher than that of females with high school averages below 80%, but that above 80% the rates would be similar, proved to be the case. The differences in the attrition rate between males and females with high school averages below 80% were 9% and 11% for males with and without disabilities respectively. However, the difference in attrition rates narrowed to 2% for both groups for high school averages above 80%. Consequently, the high rates of attrition for males with and without disabilities appears to be related to those in the lower range of high school averages.

4.3 Factors Related to Attrition

High School Average and First Semester Grades

It is generally reported in the literature that the first semester or first year GPA is a strong predictor of persistence, even when controlling for other variables (e.g. Ma & Frempong, 2008; Bradburn, 2003; Cabrera, Burkum, & La Nasa, 2005; Hoachlander, 2003; Astin & Oseguera 2003 & 2005). In our study, the first semester CRC score was in fact a stronger predictor of attrition than the high school average. Nonetheless, it still only explained between 16% and 25%

of the variance for 10th semester attrition depending on the group, and the range for 3rd semester attrition was between 6% and 20%. However, first semester grade average is not a useful predictor if students are to be identified early enough for support strategies to be put in place to deter them from leaving their studies. By the time students write their first semester exams, it is already too late for many of them. If both the high school average and the first semester grade are added to the logistic regression models we tested, then the high school average was not significant, and only the first semester grade entered the model. The two variables had, on average, a correlation of .64, which is statistically significant. The correlations for females (r = .598) and males (r = .463) with disabilities were lower than the average. (See Appendix 20 for significance and N values for the correlations between these two variables and attrition for the different groups in the study).

High School Grade and Impact on Attrition

The literature is contradictory with respect to the high school grade and its contribution to persistence. DuBrock (1999) found a pronounced effect, whereas other authors have reported limited effects (e.g. Nora, Barlow & Crisp, 2005; Adelman, 2005). Nora, Barlow & Crisp (2005) found that students who graduated in the third quartile of their high school class may keep up in their first year, but are less likely to continue in the second year. Ma and Frempong (2008) found that youths with an overall GPA at 60% or lower were 10 times more likely than youths with an overall GPA at 90% or higher, 3.45 times more likely than youths with an overall GPA at 80% or higher, and 1.64 times more likely than youths with overall GPA at 70% or higher to drop out of postsecondary education. Astin & Oseguera (2005) found the high school average to be the strongest pre-college characteristic influencing retention and degree completion.

Our findings were consistent with those of Astin & Oseguera (2005). Our hypothesis that, of the variables tested in this study, the high school average would be the strongest predictor of dropout by the third and tenth semester, proved to be the case for the most part. Females with disabilities were the one exception, and background and demographic variables proved to be better predictors of 3rd semester attrition. There was no significant correlation between 3rd semester attrition and high school grade for females with disabilities. The high school average was still, however, the strongest predictor of tenth semester attrition for this group. Having said this, the

highest correlation we found in our study was r = .39 for males without disabilities for attrition to the 10th semester. Therefore, in this case, the high school average accounted for just 15% of the total variance in dropout. In addition, the correlations were much lower for students with disabilities, and the largest amount of variance accounted for was 8% for males with disabilities for tenth semester attrition. (Appendix 20 outlines sample sizes, correlation coefficients and p values). Consequently, the strength of the relationship of high school average and attrition can vary among sub-populations, was stronger for students without disabilities compared to students with disabilities, stronger for males than for females in both groups, and stronger for 10th semester attrition compared to 3rd semester attrition. However, despite the fact that it was the strongest predictor of the variables we tested, it only accounted for a small amount of the variance in attrition.

Female and Male Dropout Differential and High School Average

We found that males entered the college with lower high school grades than females, not an unusual finding (e.g. Ma & Frempong , 2008; Hudy, 2006; McIntosh, 2007; Jorgensen, Fichten, Havel et al 2005). Given the stronger relationship between high school average and attrition for males, it is not surprising that they left at higher rates than females. However, as shown earlier, even when male high school averages were matched with those of females, the rates of attrition were still higher for males. Although both males and females with high school grades below 80% dropped out of college at higher rates than those who had averages above 80%, the impact was greater for males (9% - 11% higher than females by the tenth semester). In addition, males and females with disabilities had lower high school averages relative to their non-disabled peers. This again is not unusual and other researchers have reported similar findings (Horn & Berkold, 1999; Richardson, 2001; Richardson & Roy, 2002; Jorgensen, Fichten, Havel et al, 2005). However, despite the lower high school averages, students with disabilities did not drop out at higher rates. Consequently, factors other than the high school averages must be contributing to the higher male rates of attrition and/or the better retention rates of females and students with disabilities.

Factors Related to Attrition – Students Without Disabilities

Our hypothesis was that the variables that predicted attrition would be similar for both males and females, although their relative importance would differ. We found age and high school average to be the strongest predictors of attrition for males and females without disabilities and they

entered all the attrition models we tested for this group. For the third semester models, in addition to these two variables, language and motivation were found to be significant for females and not males. On the other hand, median family income, paid employment, level of studies, English placement level and country of birth were significant for males but not females. Consequently, contrary to our hypothesis, the statistically significant variables did differ by sex. However, they added only marginally to the ability to predict attrition. Two variables worth noting that entered the model for males, but not females are paid employment and level of studies.

Level of Studies

Males who aspired to a PhD degree had a rate of attrition of 7% compared to a rate of 31% for those who aspired to a diploma, a difference of 24%. For females the respective values were 13% and 23%, a difference of 10%. Males aspiring to a PhD was the only grouping we compared where the attrition rate was lower for males than females, and the difference was significant ($\chi 2$ (1, N = 685) = 6.15, p = .01). Other authors have also reported a relationship between degree aspirations and attrition. Bradburn (2003) reported that students entering post-secondary education who identified higher expected levels of educational attainment were less likely to leave than those identifying lower levels. Cabrera, Burkum and La Nasa (2005) also point out the importance of having high degree aspirations at an early age. Ma & Frempong (2008) found educational aspiration in high school an important variable related to the decision to drop out of postsecondary education. However, in this study the 'level of studies' variable appears to have a stronger relationship with attrition for males than females.

Paid Employment

The anticipated hours of paid employment in the upcoming semester also seemed to have a stronger relationship to male attrition. The rate of attrition for females who claimed they would be working over 15 hours per week was 21.5% compared to 27.4% for males. Under 15 hours per week the rates were approximately 14% for both groups. The effect sizes, however, were small. A number of researchers have reported on the impact of hours of paid employment on student persistence. Bean (2005) reported that working more than twenty hours a week can have negative consequences on the student's academic life. Stern (1997) and Cheng (1995) both state

that students derive benefits from working, as long as the hours are below 15 hours per week. Other studies also outlined a relationship between work intensity and persistence (Bradburn, 2003; ACE, 2001). These studies did not compare the results by sex. However, Naylor (1999) quoting from the Statistics Canada publication (Working Teens, *Canadian Social Trends*, Winter, 1994) reported lower dropout rates for those who worked under 20 hours per week. Males who worked fewer than 20 hours per week had a 16% dropout rate, and for those who worked longer than 20 hours per week the rate was 33%. The highest female dropout rate (22%) occurred among females who did not work at all. Consequently, there is some support for a differential impact of hours of paid employment on attrition depending on sex. The author also states that it is not clear whether increased work causes the academic problems, or whether academic failure leads more students to increase their work hours. It should be noted that the rates we are quoting in this study relate to the hours students anticipated they would be working in the upcoming semester. We do not know the actual hours they were employed. However, even these self-reported hours are reflected in differentials in 3rd semester dropout rates.

Tenth Semester Attrition

In the tenth semester attrition models we tested, there was more overlap in the variables that were significant for males and females. Because we had no survey outcomes over ten semesters, we worked with a more limited set of variables from the students' records. In addition to high school average and age, the median family income and language were significant for both males and females. In addition, diploma type and English placement level were significant for females but not males. Although there is evidence that variables that are statistically significant do differ for males and females, the high school average was the strongest predictor for both groups, and adding the other statistically significant variables did not improve, to any extent, the ability of the models we tested to predict attrition.

Factors Related to Attrition - Students With Disabilities

The sample size for students with disabilities was much smaller than for students without disabilities. Consequently, it is unfair to compare the variables that entered the model for students with disabilities with those of students without disabilities, where the samples were so large that small differences could prove significant. In addition, due to sample size constraints, we could only model high school average, age, median family income and English placement

level for students with disabilities. High school average and median family income were significant in the 10th semester attrition model. In the 3rd semester model only age was significant for males and high school average for females, although only marginally so ($p = .05$). The high school average was not the best predictor of attrition for males and females with disabilities.

Although we could not model the survey variables for this group, we did compare the 3rd semester attrition rate by level of variable using chi square tests. Although out-of-class study time was not significant for either males or females, it was significant when both groups were combined. There was a 15.9% difference in the 3rd semester attrition rate between those who reported they spent more than 12 hours on out-of-class study in their last year, and those who reported spending less than 12 hours, a differential that was higher than for the age (9.9%) and high school average (8.6%) variables.

4.4 Psychosocial and Study Skill Variables

Males and Females (Without Disabilities)

When we compared the scores on the psychosocial and study skill variables obtained from the ACT Student Readiness Inventory, males scored lower than females on six of the ten scales. The largest difference was on the Academic Discipline scale. According to the interpretation of this scale provided by ACT (2008), males placed less value on school work and were less conscientious than females.

Using the ISS survey variables, we also found that only 17% of males claimed they spent twelve or more hours per week on out of class study (in their last year of study) compared to 30% of females. A lower proportion of males (26.3%) than females (35.0%) claimed they would be spending more than 15 hours per week on out-of-class study in the upcoming semester. Consequently, males exhibited many of the characteristics that would pre-dispose them to dropout at higher rates than females.

At the time of writing there were too few students who dropped out to allow for modeling of attrition with the SRI scale variables. However, we did model academic performance. Of the ten SRI variables we tested, three were significantly related to CRC scores for students without

disabilities: Academic Discipline, General Determination and Academic Self-Confidence. When we entered the high school average with the SRI variables into a logistic regression model, Academic Discipline and General Determination remained significant. However, the high school average alone was the best predictor, and the accuracy of prediction did not improve when these two variables were added.

Students With Disabilities

Students with disabilities scored lower than their non-disabled peers on six of the ten SRI scales. The largest differences were on the Academic Self-Confidence scale followed by the Social Integration scale. Historically, however, students with disabilities have not dropped out at higher rates than their non-disabled peers. They did, however, achieve lower average first semester CRC scores. The difference in average CRC scores between females with and without disabilities was 2.56, and between males the difference was 5.56.

Only 17% of males claimed they spent more than 12 hours on out-of-class study compared to 41% of females. This reported tendency to spend less time on study may, in part, contribute to the lower CRC scores of males compared to females.

4.5 Models – Predicting Attrition

Of the fifteen background, demographic, and psychosocial and study skill variables we examined in addition to the high school average, many were significant in our pre-model tests, and several entered our models as statistically significant. However, a significant relationship with attrition did not mean the variables enhanced the ability to predict dropout substantially over that which could be achieved by the high school average alone. We used a number of metrics to compare the ability of different variables to discriminate between dropout and retention. One measure of this ability that we used was the area under the ROC curve, constructed from the probabilities generated from the logistic regression. Other measures were the positive predictive value (PPV) of the models and Nagelkerke R^2, a measure of effect size. The essential task for educators endeavoring to improve retention rates of their students is to provide cost-effective interventions targeted correctly to those most at risk. The positive predictive value (PPV) allows educators to do this. The PPV is the percentage of students that the model assigns to the dropout group, that are correctly classified. As the PPV varies depending on the cutoffs used, by calculating and

examining the PPV values over the whole range of probabilities assigned by the model, allows an assessment to be made at each cutoff of the number of students above that cutoff who are misclassified. This allows the benefits of the intervention to be weighed against the cost of including students who would not have dropped out in any case.

In absence of the high school average, the variables we tested did produce better than chance prediction. However, when the high school average was used as the initial predictor, the addition of the remaining variables resulted in no improvement, or only marginal improvement, to the accuracy of prediction. However, having said the high school average was the strongest predictor, did not mean it was a necessarily a good predictor. Using a rough classification of areas under the ROC curve as 'fail', 'fair', 'poor', 'good' or 'excellent', the high school average rated as a 'poor' predictor of 3rd semester attrition for females without disabilities and a 'fail' for females with disabilities. For males with and without disabilities it rated as 'poor' and 'fair' respectively. For 10th semester attrition it rated as 'poor' for both females and males with disabilities, and 'fair' for their non-disabled counterparts. The high school average was better able to discriminate between dropout/retention for males compared to females and for students with disabilities compared to students without disabilities.

When variables added to the high school average resulted in some improvement in either the AUC's or PPV's, they did so for males more so than for females. Consequently, the high school average and the variables we tested showed a stronger association with male attrition. Although the high school average was less able to predict dropout for students with disabilities compared to their non-disabled counterparts, for both groups the attrition rates were higher, and the relationship between attrition rate and the independent variables was stronger for males.

We also found that males differed from females in the variables that entered our logistic regression models. Subpopulations may differ in the variables that enter the model and the strength of the relationship between the variables and the test variable. This has also been shown by Wintre & Jaffe (2000) who reported differences in male and female models of overall adaptation to university and first semester GPA, with different amounts of variance explained by the factors they tested, depending on sex.

4.6 First Semester Academic Performance

The high school average proved to be the strongest predictor of whether a student would obtain a relatively low or high first semester grade. This is consistent with the work of other researchers. Wintre & Yaffe (2000) found that high school average was the best predictor of first-year university GPA. Vodel & Adelman (1992) found that the high school GPA was the variable most closely related to college exit GPA for a matched sample of students. Our study found that the high school average was the strongest predictor of whether a student would achieve a CRC score above or below 25 in their first semester of study. Moreover, unlike the academic attrition models, models of academic performance were equally able to discriminate between those who would achieve a CRC in the higher or lower range for males and females, with and without disabilities. The variables entering the first semester performance model varied by sex, both when using the Records variables alone and when using all variables. Wintre & Yaffe (2002) also found the models they used to examine first-year grade point averages (GPA) varied by sex. In their study they found that for males, a three variable model accounted for 48%, and for females a six variable model accounted for 38% of the variance in first semester GPA. Two of the variables were common to both sexes (high school average and academic adaptation).

The effect sizes as measured by the Nagelkerke R^2 were .42 for both males and females without disabilities. Adding the Records and ISS variables to the model improved this measure to .48 for males, but made no improvement for females. The addition of the variables to the models of students with disabilities improved the value from .38 to .42 for females and .39 to .42 for males. However, there were no improvements in the positive predictive value of the models or the areas under the ROC curves.

Over the period of this study, 59.6% of males compared to 45.2% of females entered the college with a high school average under 75%. Consequently, males are at an immediate disadvantage when they enter college, as they are less likely to perform well academically in their first semester, and first semester grade average was found to be one of the strongest predictors of attrition. A study by McIntosh (2007), using a representative sample of Canadian students, found that this sex based discrepancy in grade performance can be seen in children in age groups as young as 5 – 8. Frenette & Zeman (2007) found that by age 15 males are trailing females in

overall grade averages and standardized reading test scores. Moreover, they also reported that boys spent less time on homework than girls.

A number of studies suggested that males and females may be responding to external factors in different ways. The Frenette & Zelman study suggested that females may not be responding to economic cues (earnings advantage for university graduates) in the same way males do. McIntosh's study provided limited evidence that males may not be responding to positive parental attitudes in the same way that females do. The MELS study (MELS 2002) found that the more disadvantaged the socioeconomic environment, the lower the percentage of high school students who complete a diploma, but that boys were more affected than girls. The fact that the Wintre & Jaffe study, as well as this study, found that the models tested varied by sex, both in the number of variables entering the models, and the size of the effect, support the notion that males and females are responding to these factors in different ways. Further study is required in order to elaborate these differences. These male characteristics pose challenges for those trying to raise the retention rates of males once they reach college, as their origins stem back to elementary school.

4.7 Reasons for Leaving

Our hypotheses that 1) the most important reasons for leaving given by students with disabilities would be similar to those of students without disabilities, and not related to their disabilities, and 2) that the reasons for leaving of males and females with and without disabilities would mirror each other were not supported. A significantly larger proportion of students with disabilities (40%) than without disabilities (1%) indicated that they left Dawson due to disability/personal health issues.

There was some support for our hypothesis that the reasons for leaving for males and females would be similar, as three of the top five reasons were the same for both groups. However, attendance at university and disability/personal health issues did not rank in the top five for males, as they did for females. Attending a different college and the shooting incident did not rank in the top five for females, although they did so for males.

Our hypothesis that students who leave in the first and second semester of their programs will report different reasons for leaving their college studies, compared to those who leave in the third and fourth semesters was supported. Students leaving in their first year were more likely to say they left due to career direction uncertainty/change, or they did not like the program they were in. The most frequent response category for students who left later in their studies was low motivation and other factors inside the college.

4.8 Profiles of Males and Students With Disabilities

Data derived from a number of sources including this study (Records, Incoming Students Survey, Student Readiness Inventory, Reasons for Leaving Survey) in addition to our findings from survey work we have done previously (Course Experience Questionnaire (CEQ) (Fichten, Jorgensen, Havel et al, 2006), and our studies on graduation rates and academic performance (Jorgensen, Fichten & Havel, 2003) and college exit grades (Jorgensen, Fichten & Havel, 2007), we are beginning to learn more about the similarities and differences in the academic, demographic, psychosocial and study skill profiles of males and females, and students with and without disabilities. The following is a summary of findings that have emerged from our research program to date.

4.8.1 Profile of Students With Disabilities

Academic Profile

Students with disabilities, compared to their non-disabled peers:

- Were more likely to be enrolled in the pre-university sector
- Had a higher proportion of students entering with high school averages under 75%
- Had lower college exit grades if they had a learning disability - otherwise grades were comparable (Jorgensen Fichten & Havel, 2007)
- Took, on average, one semester longer to graduate (Jorgensen Fichten & Havael, 2003)
- Females were equally likely, but males were less likely to be in their first choice program
- Reported similar levels of motivation to students without disabilities
- Reported similar degree aspirations to students without disabilities

Attrition Profile

Compared to their nondisabled peers, students with disabilities

- Tended to drop out at a lower rate in the early semesters, but at a higher rate in the later semesters
- Had graduation and attrition rates by the tenth semester that were similar
- Models of attrition that showed weaker relationships with the variables tested in this study
- High school averages were not the best predictor of third semester attrition

Demographic Profile

Compared to their non disabled peers, students with disabilities had a higher proportion of students who**:**

- Were male
- Were born in Canada
- Had English as their mother tongue
- Had fathers who were born in Canada
- Originated from postal codes with higher median family incomes
- Were not first generation college students
- Were less likely to report they would be working in the upcoming semester
- Reported they would be working on average 15 hours per week, as was the case for students without disabilities (for those planning to be in paid employment)

Psychosocial and Study Skill Profile

Students with disabilities compared to their non-disabled peers:

- Scored lower on six of the ten psychosocial and study skill scales of the Student Readiness Inventory, with the biggest differences showing on the Academic Self-Confidence and Social Integration scales.

Perceptions of Obstacles and Facilitators of College Success

Graduates with disabilities (Fichten, Jorgensen, Havel et. al. 2006):

- Rated the availability of disability services on campus as the strongest facilitator of their college success
- Were more likely to rate their health as an obstacle to college success
- Who registered for disability related services at the college rated their college experiences as easier than graduates with disabilities who did not register, and graduates without disabilities

Reasons for Leaving

Our preliminary analysis of Reasons for Leaving data found that a higher proportion of students with disabilities claimed they left because:

- Of health related problems
- They experienced emotional problems
- They felt alone and isolated

4.8.2 Profile of Males

Academic Profile

In comparison to females, males:

- Entered the college with lower high school averages
- Were less likely to be in their first choice program
- Had similar aspirations to obtain a higher degree
- Reported lower levels of motivation
- Had lower first semester CRC scores

Demographic Profile

Males were:

- More likely to have mothers and fathers who were born outside of Canada
- Equally likely as females to be a first generation college student
- Less likely to report they would be working in the upcoming semester

Attrition Profile

- Male rates of attrition were 10% - 12% higher than those of females
- For equivalent high school averages males had higher attrition rates than females, especially for high school averages below 80%
- Higher degree aspirations had a larger influence on male attrition/retention compared to female attrition/retention. Males aspiring to PhD had substantially lower attrition rates
- For equivalent hours of paid employment over 15 hours per week, males were more likely to drop out than females
- Using the variables in this study, it was possible to more accurately predict male attrition than female attrition

Psychosocial and Study Skill Profiles

Compared to females, males:

- Were less likely to claim they spent more than 12 hrs per week on study at college in their last year of study
- Were less likely to claim they would be spending 15 hrs per week or more on out of class study in the upcoming semester
- Were less likely to believe they "know how to assess an academic problem, organize a solution, and successfully complete academic assignments" ACT (2008) (i.e., lower scores on the SRI Study Skills Scale)
- Less determined to complete college, overcome obstacles and less likely to appreciate the value of a college education (i.e., lower scores on the SRI Commitment to College scale)
- Placed less value on school work and were less conscientious (i.e., lower scores on the SRI Academic Discipline scale)
- Were less likely to follow through on commitments and obligations (i.e., lower scores on the SRI General Determination scale)
- Less attentive to others' feelings, and less flexible in resolving conflicts (i.e., lower scores on the SRI Communication Skills Scale)
- Felt less connected with and involved in the college community (i.e., lower scores on the SRI Social Connection scale)
- Were equally likely as females to feel that they were able to set goals and make efforts to achieve them and were as confident that they could do so (SRI Goal Striving scale); believed they were able to perform well in school (SRI Academic Self-Confidence scale) and had the ability to control strong emotions (SRI Steadiness scale).

4.9 Recommendations

One of the objectives of the study was to make recommendations tailored to the specific needs of our target groups. The following are recommendations that have emerged from the different profiles we have developed of males and students with disabilities.

Students With Disabilities

Our past research has shown that students who register with the college's Services for Students With Disabilities experienced their college studies as easier (Ficten et al., 2006). Students with

Disabilities reported lower scores on the Academic Self Confidence and Social Integration scales of the SRI survey. The main reason that students with disabilities gave for leaving the college was because of disability/personal health issues. Our preliminary analysis of the closed ended questions on the Reasons for Leaving survey showed that students with disabilities were more likely to report feeling alone and isolated. Registering with the disability service provider has a number of advantages. It provides a place where students with disabilities can meet, interact, arrange social activities, be referred to the services available on campus (e.g. financial aid, peer tutoring) and access resource materials that allow them to participate in learning activities (material in alternative formats, adaptive technologies). This allows students to build confidence in their academic abilities, feel more connected to the campus community and participate in both the academic and social life of the college. We base the following recommendations on these findings.

Recommendation 1

Information needs to be disseminated to students with disabilities, advising them of the disability services available at college while they are still in high school. Students need to be encouraged to take advantage of these services.

Our analysis of the closed ended questions on the Reason for Leaving survey indicated that students felt that their chosen occupation did not require college study, despite the earnings advantage conferred by a college diploma or university degree.

Recommendation 2

Students with disabilities need to be provided with career guidance integrated with course planning so they are able to complete their studies in the areas in which they are most interested. They need to be made aware of earnings advantages of postsecondary education for students with disabilities.

Recommendation 3

Students with disabilities need to be provided with role models who have achieved academic and career success (e.g. through guest speakers and student mentors).

As the result of a survey conducted by Hably and Mclanahan (2004), advising interventions were recommended for selected student populations. As students with disabilities enter the college with lower high school averages advisors can provide:

Recommendation 4
Guidance in the selection of appropriate remedial courses tailored to the need of the individual, and referral of students to tutoring services for specific courses in which they may experience difficulty.

Hanly & McLanahan (2004) also advised colleges not to make first to second year strategies the sole focus. This is especially true of students with disabilities, where the largest percentage of students dropout after entry into the second year:

Recommendation 5
Provide support and encouragement to students with disabilities throughout their studies as course material becomes increasingly difficult.

The most frequent reason for leaving reported by students with disabilities on the open-ended responses to the Reason for Leaving Survey was disability/personal health issues:

Recommendation 6
Administrative policies need to be flexible so that students with disabilities can reenter their studies after a period of medical leave with as little disruption to their studies as possible. Policies and practices need to be reviewed to ensure students with disabilities are not unduly disadvantaged.

Males

Males entered the college with lower high school averages and achieved lower first semester grades. Although males were as likely as females to report that they were able to set goals, and were confident they could achieve them, and believed they were able to perform well in school, they scored lower than females on six of the Student Readiness Inventory scales, with the largest difference on the Academic Discipline scale. The ACT Users Guide (2008) claims that students

scoring low on this scale tend to view other elements of their lives as more important than completing school related tasks. For males, the scores on the Social Connection and Social Activity scales (on entry to the college) were negatively correlated with first semester CRC. Although very low or very high scores on the Social Activity scale were shown to have negative effects on academic success (e.g. high levels of social activity, tend to interfere with studies (ACT, 2008)), it is more difficult to understand the negative correlation on the Social Connection scale, as social connection is generally related with better performance academically. It should, however, be pointed out that this measure was not related to Social Connection or Social Activity at the college, as the data was collected prior to, or near the time students entered their studies. However, the two scales were more highly correlated in this study than reported in the ACT User's Manual (2008) ($r = .62$ vs. $r = .49$), and it is possible that if the social connection was being achieved through increased social activities, that the scores for both measures could be negatively correlated with CRC score.

Compared to females, males reported spending less time on out-of-class study (in their last study year) and that they would be spending less time on study in the upcoming semester. They also tended to report lower levels of motivation, and this was one of the main reasons given by males for leaving. Given this male profile we make recommendations that are designed to increase the commitment to college, academic discipline and the motivation of male students.

Recommendation 1

Males with low high school averages need to be identified early, and directed to the academic skills center where they can be assessed, and tutored in areas where they are weak. The challenge is to successfully encourage males to participate in these activities through early outreach programs.

Recommendation 2

Males need to receive support in traditional study skills, time management, assignment organization and completion, priority setting and how to follow through on academic commitments. They need support in order to develop successful study techniques, and the discipline to apply them.

Recommendation 3

Males need to be encouraged to participate in extracurricular activities related to their areas of interest (sports, clubs), but not to the extent that it interferes with their studies. This can improve motivation and increase the desire to succeed academically.

Recommendation 4

Career counseling should direct males toward careers in their areas of interest, and to the college courses required to enter these occupations.

Recommendation 5

Work/study programs need to be introduced into the curriculum and start early. This can serve to increase the commitment of males to complete the studies that are prerequisite to entering into their occupations of interest. Males may be more motivated to stay at college, and do well if they can participate in meaningful work/study programs where they are able to see a connection between what they are learning and its application in the workplace.

4.10 Limitations of Study

The study examines attrition at a single institution which limits the ability to generalize the findings. We know not only from our Reasons for Leaving survey, but also from data sets provided from the Quebec government that students at this particular institution do go on to other colleges or directly to university and, therefore, do not really drop out of post secondary education.

The data (excluding survey data) was averaged for entering cohorts over varying periods from 1990 - 2006. This assured a good representation of students with disabilities. However, during this period the characteristics of students entering the college, economic conditions, educational reforms and technological advances may have changed, and influenced the factors predictive of persistence and drop out. Survey data was only collected for three years for the Incoming Student Survey and only one year for the Student Readiness Inventory. These variables could not be modeled over the longer term. Consequently, comparing a complete set of variables over the three year and ten year time frames was not possible.

The income variable did not reflect the actual life circumstances of students, but was derived from students' postcodes using Statistics Canada data. Moreover, the income was not adjusted for inflation across years, although this was somewhat offset by using it as a binary variable.

The numbers of students with disabilities was small compared to the numbers without disabilities, and, therefore, in many cases there were large differences in the variable levels that were not significant for this group of students, whereas small differences in the variables for students without disabilities were. We also did not examine differences among the different types of disabilities.

When using data derived from surveys, we found that survey responders differed from non-responders in the very characteristics we were modeling. Survey responders tended to have lower rates of attrition and higher first semester CRC scores. Consequently, if survey data is useful in predicting attrition, it should be collected in class or under other circumstances where close to complete response rates are assured. Otherwise, it is probably better to use variables that are readily obtained from the students' records.

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Appendices to the Report

Predicting the At-Risk Status of Males and Students With Disabilities

Appendix 1

Attrition/Retention at the Beginning of the Tenth Semester by Level of Predictor Variable

Variable	Variable Level	N	Retention	Attrition		Value	df	p
Sex	Females	17152	63.3%	36.7%	Pearson Chi-Square	438.15	1	0.000
	Males	14103	51.5%	48.5%	Likelihood Ratio	438.22	1	0.000
	F + M	**31255**	**58.0%**	**42.0%**	N of Valid Cases	31255		
Age	Under 17	1092	71.7%	28.3%	Pearson Chi-Square	1877.7	3	0.00
	17	20948	65.1%	34.9%	Likelihood Ratio	1873	3	0.00
	18	5016	45.6%	54.4%				
	19 and over	4199	33.4%	66.6%				
	All Ages	**31255**	**58.0%**	**42.0%**				
COB	Born outside	5515	53.7%	46.3%	Pearson Chi-Square	49.13	1	0.000
(Country of Birth)	Born in Canada	25739	58.9%	41.1%	Likelihood Ratio	48.83	1	0.000
	All Countries	**31254**	**58.0%**	**42.0%**	N of Valid Cases	31254		
				5.1%				
EP Level	0	319	37.0%	63.0%				
English placement	1	1132	45.7%	54.3%				
	2	1810	59.6%	40.4%	Pearson Chi-Square	308.94	4	0.000
	3	4747	54.6%	45.4%	Likelihood Ratio	303.71	4	0.000
	4	18340	63.3%	36.7%	N of Valid Cases	26348		
	All levels	**26348**	**60.4%**	**39.6%**				
	No record	4907	44.7%	55.3%				
	Total	31255	58.0%	42.0%				
					Pearson Chi-Square	30.60	2	0.000
Language	French	3987	54.0%	46.0%	Likelihood Ratio	30.42	2	0.000
	English	18852	58.3%	41.7%	N of Valid Cases	31255		
	Other language	8416	59.0%	41.0%				
	All languages	**31255**	**58.0%**	**42.0%**				
Diploma Type	PreUniversity	2419	59.5%	40.5%	Pearson Chi-Square	120.60	2	0.000
	Technical	23834	55.0%	45.0%	Likelihood Ratio	119.48	2	0.000
	A&T	5002	49.0%	51.0%	N of Valid Cases	31255		
	All Programs	**31255**	**58.0%**	**42.0%**				

Appendix 1 (continued)
Attrition/Retention at the Beginning of the Tenth Semester by Level of Predictor Variable

Variable	Variable Level	N	Retention	Attrition	Chi-Square	Value	df	p
High Scool Average								
% Groups	50 - 60 (57.1)	575	22.6%	77.4%	Pearson Chi-	3086.7	4	0
Average for group is	61 - 70 (66.4)	6848	37.9%	62.1%	Likelihood Ratio	3214.4	4	0
	71 - 80 (74.7)	11760	64.5%	35.5%	N of Valid Cases	24556		
	81 - 90 (83.4)	4916	82.9%	17.1%				
	91 - 100 (91.9)	457	90.8%	9.2%				
	All groups	**24556**	**60.3%**	**39.7%**				
	No record	6699	49.5%	50.5%				
	Total	31255	58.0%	42.0%				
Median Family Income (PC)								
2	0 - 20000	371	49.1%	50.9%	Pearson Chi-	269.29	9	0.000
3	21000 - 30000	2063	51.1%	48.9%	Likelihood Ratio	272.06	9	0.000
4	31000 - 40000	4090	54.5%	45.5%	N of Valid Cases	27973		
5	41000 - 50000	5369	54.8%	45.2%				
6	51000 - 60000	4916	56.5%	43.5%				
7	61000 - 70000	3313	59.9%	40.1%				
8	71000 - 80000	2459	61.6%	38.4%				
9	81000 - 90000	1363	63.9%	36.1%				
10	91000 - 100000	1015	67.4%	32.6%				
11	>100000	3014	66.8%	33.2%				
	Total	**27973**	**58.1%**	**41.9%**				
No information		3282	56.7%	43.3%				
		31255	58.0%	42.0%				
Disability Status	No Disabilities	30498	57.9%	42.1%	Pearson Chi-	1.48	1	0.224
	With Disabilities	757	60.1%	39.9%	Likelihood Ratio	1.48	1	0.223
		31255	58.0%	42.0%	N of Valid Cases	31255		

Appendix 2

Output of 10th Semester Attrition Model - Records Variables - All Students

Enter Method Cutoff = .40 *N = 22444*

	B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I. for EXP(B)	
							Lower	Upper
Comm S DipType			14.51	2	0.001			
Comm S DipType(1)	0.155	0.042	13.763	1	0.000	1.168	1.076	1.268
Comm S DipType(2)	0.074	0.052	2.013	1	0.156	1.076	0.972	1.192
LANGUAGE			95.249	2	0.000			
LANGUAGE(1)	-	0.047	54.079	1	0.000	0.710	0.648	0.778
LANGUAGE(2)	-	0.053	93.712	1	0.000	0.598	0.539	0.663
Age	0.122	0.018	45.656	1	0.000	1.129	1.090	1.170
Eng placeLEV			29.111	4	0.000			
Eng placeLEV(1)	-	0.164	1.943	1	0.163	0.795	0.576	1.097
Eng placeLEV(2)	-	0.158	10.589	1	0.001	0.597	0.438	0.815
Eng placeLEV(3)	-	0.155	14.339	1	0.000	0.556	0.411	0.754
Eng placeLEV(4)	-	0.153	10.755	1	0.001	0.606	0.449	0.818
Median Family Income	0.000	0.000	25.420	1	0.000	1.000	1.000	1.000
COB01(1)	-	0.055	0.183	1	0.669	0.977	0.878	1.087
Sex01(1)	-	0.030	88.726	1	0.000	0.752	0.709	0.798
Dis01(1)	-	0.095	5.993	1	0.014	0.792	0.657	0.955
HS Average	-	0.000	1965.770	1	0.000	0.989	0.988	0.989
Constant	6.871	0.445	238.764	1	0.000	963.8765		

Appendix 3

10th Semester Logistic Regression Scores (Pre Model Test) Generated by Model 3 (8 Records Variables & HS Grade - Sex used as selection variable)

Enter Method Cutoff = .40

	Variable	Score	df	Sig.	Rank
Females	High School Average	1388.34	1	0.000	1
N =	Age	247.18	1	0.000	2
12593	Eng_placeLEV	97.15	2	0.000	3
	Median Family Income (PC)	80.21	1	0.000	4
	Comm S DipType	70.21	2	0.000	5
	Comm S DipType(1)	66.54	1	0.000	
	Eng placeLEV(2)	51.9	1	0.000	
	Language	41.34	1	0.000	6
	Eng placeLEV(1)	25.15	1	0.000	
	Comm S DipType(2)	23.34	1	0.000	
	Eng placeLEV(4)	10.73	1	0.001	
	COB01(1)	1.56	1	0.212	
	Dis01(1)	0.04	1	0.837	
	Eng placeLEV(3)	0.03	1	0.860	
Males	High School Average	1440.36	1	0.000	1
N =	Age	360.85	1	0.000	2
10947	Eng_placeLEV	133.58	4	0.000	3
	Eng placeLEV(4)	75.34	1	0.000	
	Median Family Income (Post Code)	72.61	1	0.000	4
	Comm S DipType	50.59	2	0.000	5
	Comm S DipType(1)	46.18	1	0.000	
	Eng placeLEV(2)	21.97	1	0.000	
	Comm S DipType(2)	12.83	1	0.000	
	Eng placeLEV(1)	11.89	1	0.001	
	Language	5.88	1	0.015	6
	Eng placeLEV(3)	1.52	1	0.218	
	Dis01(1)	0.76	1	0.383	
	COB01(1)	0	1	0.956	

Appendix 4

Output of Logistic Regression Model for 10th Semester Attrition (HS Grade & 8 Records Variables) by Sex.

Cutoff = .40, Enter Method

Sex		B	S.E.	Wald	df	Sig.	Exp(B)
Females	Comm S DipType			9.491	2	0.009	
	Comm S DipType(1)	-0.112	0.073	2.359	1	0.125	0.894
N = 12593	Comm S DipType(2)	0.055	0.086	0.410	1	0.522	1.057
	Language	-0.300	0.035	73.627	1	0.000	0.741
	Age	0.076	0.021	12.793	1	0.000	1.079
	Eng placeLEV			41.919	4	0.000	
	Eng placeLEV(1)	0.682	0.211	10.471	1	0.001	1.978
	Eng placeLEV(2)	0.396	0.104	14.443	1	0.000	1.485
	Eng placeLEV(3)	-0.037	0.081	0.210	1	0.647	0.963
	Eng placeLEV(4)	-0.196	0.054	13.148	1	0.000	0.822
	Median Family Income	0.000	0.000	17.527	1	0.000	1.000
	COB01(1)	0.089	0.071	1.571	1	0.210	1.093
	Dis01(1)	0.131	0.129	1.022	1	0.312	1.139
	High School Average	-0.011	0.000	1015.903	1	0.000	0.989
	Constant	6.770	0.524	167.098	1	0.000	871.686
Males	Comm S DipType			7.026	2	0.030	
	Comm S DipType(1)	-0.048	0.075	0.406	1	0.524	0.954
N = 10947	Comm S DipType(2)	0.112	0.088	1.614	1	0.204	1.119
	Language	-0.190	0.040	22.360	1	0.000	0.827
	Age	0.179	0.028	40.934	1	0.000	1.196
	Eng placeLEV			4.469	4	0.346	
	Eng placeLEV(1)	0.337	0.217	2.409	1	0.121	1.401
	Eng placeLEV(2)	0.170	0.114	2.252	1	0.133	1.186
	Eng placeLEV(3)	0.066	0.091	0.516	1	0.473	1.068
	Eng placeLEV(4)	0.032	0.057	0.309	1	0.578	1.032
	Median Family Income	0.000	0.000	10.808	1	0.001	1.000
	COB01(1)	0.052	0.076	0.466	1	0.495	1.053
	Dis01(1)	0.404	0.140	8.375	1	0.004	1.499
	High School Average	-0.012	0.000	947.236	1	0.000	0.988
	Constant	5.455	0.644	71.814	1	0.000	233.997

Appendix 5

Pre-Model Test and 10th Semester Regression Model Showing Significant Variables for Students With and Without Disabilities

Enter Method, Cutoff = .40;

Students without Disabilities N = 21822.

Variables Not in the Equation				**Variables in the Equation**								
Variables	Score	df	Sig.		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
Diploma Type PreU	135.75	2	0.000	Diploma Type PreU			15.944	2	0.000			
Diploma Type Tech	41.989	1	0.000	Diploma Type Tech	0.167	0.042	15.582	1	0.000	1.181	1.088	1.283
Diploma Type A&T	76.423	1	0.000	Diploma Type A&T	0.064	0.052	1.479	1	0.224	1.066	0.962	1.181
French	45.526	2	0.000	French			116.091	2	0.000			
English	3.343	1	0.067	English	-0.389	0.045	74.370	1	0.000	0.678	0.621	0.741
Other Language	10.314	1	0.001	Other Language	-0.560	0.053	111.498	1	0.000	0.571	0.515	0.634
Age (01)	1022.4	1	0.000	Age01(1)	-0.498	0.039	162.795	1	0.000	0.608	0.563	0.656
Eng Place 01	156.9	1	0.000	EngPlace01(1)	0.056	0.035	2.663	1	0.103	1.058	0.989	1.132
Median Family Income	156.16	1	0.000	Median Family	-0.201	0.032	40.513	1	0.000	0.818	0.769	0.870
COB (01)	0.879	1	0.348	COB01(1)	-0.026	0.051	0.254	1	0.614	0.974	0.881	1.078
Sex 01	303.13	1	0.000	Sex01(1)	-0.285	0.031	86.216	1	0.000	0.752	0.708	0.799
High School Average	2968.2	1	0.000	High School Average	-0.011	0.000	1822.691	1	0.000	0.989	0.989	0.990
Overall Statistics	3388.8	10	0.000	Constant	8.514	0.196	1883.462	1	0.000	4985.61		

Appendix 5 (continued).

Students with Disabilities (N = 561)

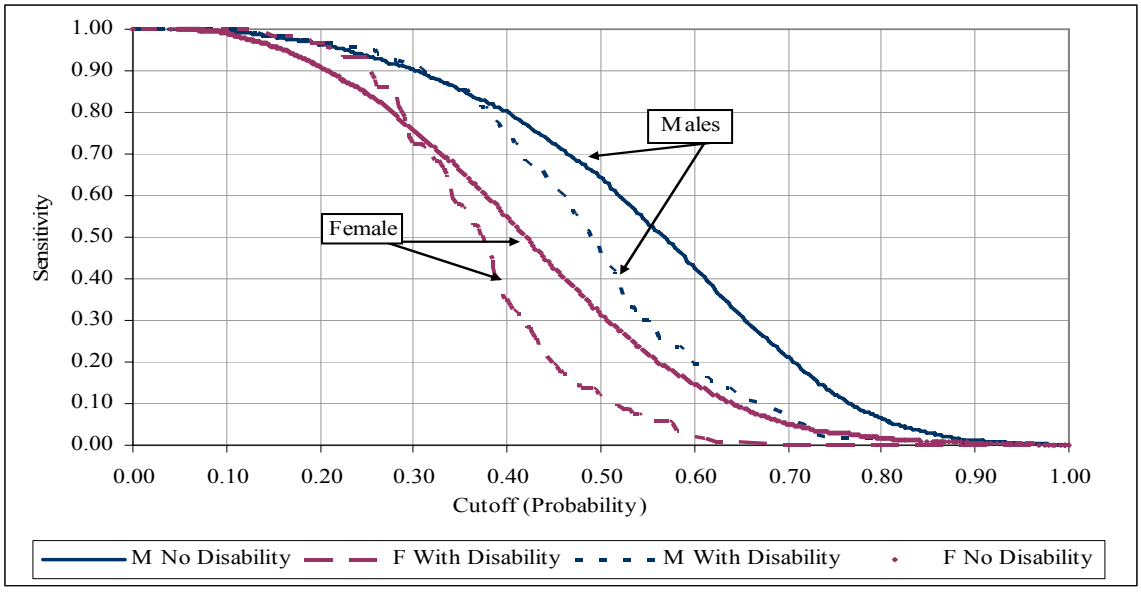
Pre Test Variables Not in the Equation				**Variables in the Equation**							95.0% C.I.for EXP(B)	
Variables	Score	df	Sig.		B	S.E.	Wald	df	Sig.	Exp(B)		
Diploma Type PreU	1.380	2	0.502	Diploma Type PreU			0.489	2	0.783			
Diploma Type Tech	0.390	1	0.531	Diploma Type Tech	0.160	0.284	0.318	1	0.573	1.174	0.672	2.050
Diploma Type A&T	0.840	1	0.360	Diploma Type A&T	0.155	0.325	0.227	1	0.634	1.168	0.617	2.210
French	0.220	2	0.895	French			1.434	2	0.488			
English	0.000	1	0.945	English	-0.358	0.386	0.860	1	0.354	0.699	0.328	1.489
Other Language	0.080	1	0.783	Other Language	-0.620	0.522	1.408	1	0.235	0.538	0.193	1.498
Age (01)	11.01	1	0.001	Age (01)	-0.148	0.206	0.511	1	0.475	0.863	0.576	1.293
EngPlace 01	7.630	1	0.006	EngPlace 01	-0.235	0.193	1.481	1	0.224	0.791	0.541	1.154
Median Family Income (01)	*3.770*	*1*	*0.052*	*Median Family Income (01)*	-0.448	0.195	5.289	1	0.021	0.639	0.436	0.936
COB (01)	1.500	1	0.221	COB (01)	-0.425	0.337	1.586	1	0.208	0.654	0.338	1.266
Sex 01	5.170	1	0.023	Sex 01	-0.117	0.193	0.367	1	0.545	0.890	0.609	1.299

Appendix 6

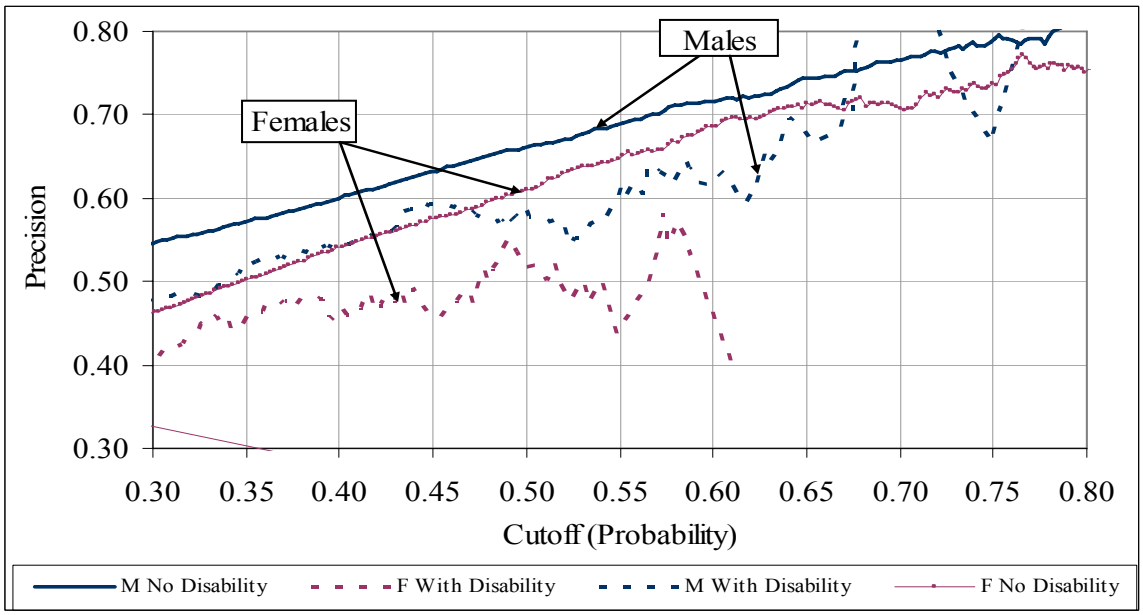
10th Semester Attrition Model Sensitivity and Precision - Comparing Males and Females With and Without Disabilities Across the Cutoff Range.

High School Average (Model 1)

Sensitiivity



Precision



Appendix 7

Attrition Rates to the Third Semester (1990 - 2006)

Students With Disabilities

Variables With 2 Levels		**Females**				**Males**				**All Students**			***ChiSq**	**df**	**Sig**
Variables	N	0	1	Diff	N	0	1	diff	N	0	1	Diff			
High School Average (0: Under 75; 1: 75 & Over	509	14.4	8.0	6.4	449	18.8	9.7	9.1	958	16.8	8.6	8.2	12.24	1	0.000
Age (0: Over 17; 1: <=17)	570	19.5	10.1	9.3	526	22.4	12.3	10.0	1096	21.0	11.1	9.9	19.70	1	0.000
English Placement Level (0: Low; 1: High)	522	16.3	10.4	5.9	462	16.9	15.4	1.5	984	16.6	12.7	3.9	2.97	1	0.085
Median Family Income (PC) (0: Below 60,000; 1: Above 60,000)	558	16.5	9.7	6.9	521	16.3	16.3	0.0	1079	16.4	13.1	3.4	2.40	1	0.121
Country of Birth (0: Outside Canada; 1: In Canada)	570	18.5	12.5	6.0	526	18.0	16.2	1.8	1096	18.3	14.3	4.0	1.31	1	0.253

Variables With 3 Levels		**Females**				**Males**				**All Students**			***ChiSq**	**df**	**Sig**
Level of Variable	N	Level 1	Level 2	Level 3	N	Level 1	Level 2	Level 3	N	Level 1	Level 2	Level 3			
Diploma Type (1: Pre-University; 2: Careers; 3 Transition Sessions)	570	13.6	8.2	17.1	526	17.8	8.5	12.8	1096	15.6	8.3	15.0	4.86	2	0.088
*Language (1: French, 2: English, 3: Other)	570	17.0	12.3	16.7	526	11.1	17.2	11.1	1096	14.9	14.7	14.3	0.02	2	0.992

* Chi sq is evaluated for the males and females combined; If the sample is significant for males or females the differences are highlighted

Appendix 7 continued

Students Without Disabilities

		Females			Males				All Students				*ChiSq	df	Sig
Variables With 2 Levels	N	0	1	Diff	N	0	1	diff	N	0	1	Diff			
High School Average (0: Under 75; 1: 75 & Over	18323	28.3	12.3	16.0	14066	33.8	12.2	21.6	32389	31.0	12.3	18.7	1665.84	1	0.000
Age (0: Over 17; 1: <=17)	22140	34.7	16.8	17.9	17446	41.0	20.7	20.2	39586	37.9	18.5	19.4	1645.54	1	0.000
English Placement Level (0: Low; 1: High)	19806	22.0	19.2	2.9	14922	28.5	23.5	5.0	34728	24.9	21.0	3.9	68.28	1	0.000
Median Family Income (PC) (0: Below 60,000; 1: Above 60,000)	21824	23.2	18.4	4.9	17277	29.5	23.9	5.7	39101	26.0	20.8	5.2	140.35	1	0.000
Country of Birth (0: Outside Canada; 1: In Canada)	22139	23.9	20.8	3.1	17446	28.2	26.9	1.2	39585	25.9	23.4	2.5	19.93	1	0.000

Variables With 3 Levels		Females			Males				All Students				*ChiSq	df	Sig
Level of Variable	N	Level 1	Level 2	Level 3	N	Level 1	Level 2	Level 3	N	Level 1	Level 2	Level 3			
Diploma Type (1: PreUuniversity; 2: Careers; 3 Transition Sessions)	22140	20.8	22.5	22.6	17446	20.5	24.3	29.9	39586	23.70	23.33	26.09	9.67	2	0.008
*Language (1: French, 2: English, 3: Other)	22140	24.7	21.5	18.5	17446	30.0	27.0	26.4	39586	26.8	24.0	22.1	43.3	2	0.000

* Chi sq is evaluated for the males and females combined; If the sample is significant for males or females the differences are highlighted

Appendix 8
Variables Entering 10th Semester Attrition Model by Sex and Disability
DisabilityNov17.xls

	Sex		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% Lower	Upper
No	F	Comm S DipType			8.732	2	0.013			
		Comm_S_DipType(1)	0.171	0.059	8.422	1	0.004	1.186	1.057	1.331
		Comm_S_DipType(2)	0.072	0.073	0.965	1	0.326	1.074	0.931	1.239
	N = 12281	LANGUAGE			92.400	2	0.000			
		LANGUAGE(1)	-0.428	0.059	53.193	1	0.000	0.652	0.581	0.732
		LANGUAGE(2)	-0.663	0.070	89.846	1	0.000	0.515	0.449	0.591
		Age01(1)	-0.516	0.055	89.611	1	0.000	0.597	0.536	0.664
		EngPlace01(1)	0.125	0.047	6.944	1	0.008	1.133	1.032	1.243
		MedianFamInc01(1)	-0.215	0.043	24.983	1	0.000	0.807	0.742	0.878
		COB01(1)	-0.068	0.071	0.919	1	0.338	0.934	0.813	1.073
		High School Average	-0.010	0.000	907.735	1	0.000	0.990	0.989	0.991
		Constant	7.786	0.263	873.892	1	0.000	2407.849		
	M	Comm S DipType			7.516	2	0.023			
		Comm_S_DipType(1)	0.166	0.061	7.443	1	0.006	1.181	1.048	1.330
		Comm_S_DipType(2)	0.054	0.075	0.520	1	0.471	1.056	0.911	1.223
	N = 9601	LANGUAGE			30.165	2	0.000			
		LANGUAGE(1)	-0.335	0.070	22.643	1	0.000	0.715	0.623	0.821
		LANGUAGE(2)	-0.431	0.082	27.816	1	0.000	0.650	0.554	0.763
		Age01(1)	-0.474	0.056	71.424	1	0.000	0.623	0.558	0.695
		EngPlace01(1)	-0.013	0.051	0.062	1	0.803	0.987	0.894	1.091
		MedianFamInc01(1)	-0.184	0.046	15.746	1	0.000	0.832	0.759	0.911
		COB01(1)	0.013	0.075	0.030	1	0.863	1.013	0.874	1.174
		High School Average	-0.012	0.000	913.100	1	0.000	0.988	0.988	0.989
		Constant	9.046	0.297	926.396	1	0.000	8487.796		

Appendix 8 (continued)

Variables Entering 10th Semester Attrition Model by Sex and Disability

	Sex		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
									Lower	Upper
With Disabilities	F	Comm S DipType			1.596	2	0.450			
		Comm_S_DipType(1)	0.347	0.359	0.933	1	0.334	1.414	0.700	2.858
	N = 312	Comm_S_DipType(2)	0.427	0.459	0.863	1	0.353	1.532	0.623	3.769
		LANGUAGE			4.289	2	0.117			
		LANGUAGE(1)	-0.664	0.444	2.236	1	0.135	0.515	0.216	1.229
		LANGUAGE(2)	-1.451	0.722	4.036	1	0.045	0.234	0.057	0.965
		Age01(1)	0.080	0.300	0.071	1	0.790	1.083	0.602	1.950
		EngPlace01(1)	-0.023	0.274	0.007	1	0.934	0.978	0.571	1.674
		MedianFamInc01(1)	-0.395	0.271	2.133	1	0.144	0.673	0.396	1.145
		COB01(1)	-0.138	0.465	0.088	1	0.767	0.871	0.350	2.167
		High School Average	-0.011	0.002	20.276	1	0.000	0.989	0.985	0.994
		Constant	8.030	1.867	18.503	1	0.000	3072.256		
	M	Comm S DipType			0.622	2	0.733			
		Comm_S_DipType(1)	-0.314	0.504	0.388	1	0.534	0.730	0.272	1.963
	N = 346	Comm_S_DipType(2)	-0.264	0.476	0.307	1	0.579	0.768	0.302	1.954
		LANGUAGE			0.995	2	0.608			
		LANGUAGE(1)	0.712	0.897	0.629	1	0.428	2.038	0.351	11.824
		LANGUAGE(2)	1.031	1.035	0.992	1	0.319	2.803	0.369	21.307
		Age01(1)	-0.462	0.299	2.384	1	0.123	0.630	0.351	1.132
		EngPlace01(1)	-0.465	0.284	2.667	1	0.102	0.628	0.360	1.097
		MedianFamInc01(1)	-0.433	0.295	2.156	1	0.142	0.649	0.364	1.156
		COB01(1)	-1.027	0.584	3.096	1	0.079	0.358	0.114	1.124
		High School Average	-0.010	0.003	12.421	1	0.000	0.990	0.985	0.996

Appendix 9

Attrition to the 3rd Semester Variables Entering the Logistic Regression Model by Sex and Disability

Semester1_3RecordsDisability.xls

			B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B) Lower	Upper
No Disabilities	F	Comm_S_DipType			2.502	2.000	0.286			
		Comm_S_DipType(1)	-0.003	0.059	0.002	1.000	0.965	0.997	0.889	1.120
	N =17244	Comm_S_DipType(2)	-0.117	0.075	2.472	1.000	0.116	0.889	0.768	1.029
		LANGUAGE			107.916	2.000	0.000			
		LANGUAGE(1)	-0.341	0.056	37.386	1.000	0.000	0.711	0.638	0.793
		LANGUAGE(2)	-0.729	0.070	107.912	1.000	0.000	0.483	0.421	0.554
		Age01(1)	-0.618	0.051	144.309	1.000	0.000	0.539	0.487	0.596
		EngPlace01(1)	0.132	0.046	8.272	1.000	0.004	1.141	1.043	1.249
		MedianFamInc01(1)	-0.170	0.042	16.257	1.000	0.000	0.844	0.777	0.916
		COB01(1)	-0.046	0.070	0.436	1.000	0.509	0.955	0.833	1.095
		High School Average	-0.007	0.000	553.416	1.000	0.000	0.993	0.992	0.993
		Constant	5.002	0.243	422.425	1.000	0.000	148.766		
	M	Comm_S_DipType			4.817	2.000	0.090			
		Comm_S_DipType(1)	-0.130	0.060	4.655	1.000	0.031	0.878	0.781	0.988
	N = 12795	Comm_S_DipType(2)	-0.054	0.072	0.559	1.000	0.454	0.947	0.822	1.092
		LANGUAGE			21.314	2.000	0.000			
		LANGUAGE(1)	-0.270	0.066	16.569	1.000	0.000	0.763	0.670	0.869
		LANGUAGE(2)	-0.342	0.078	18.934	1.000	0.000	0.711	0.609	0.829
		Age01(1)	-0.631	0.052	150.144	1.000	0.000	0.532	0.481	0.588
		EngPlace01(1)	0.061	0.048	1.601	1.000	0.206	1.063	0.967	1.169
		MedianFamInc01(1)	-0.111	0.045	6.098	1.000	0.014	0.895	0.819	0.977
		COB01(1)	0.217	0.074	8.626	1.000	0.003	1.242	1.075	1.435
		High School Average	-0.009	0.000	594.387	1.000	0.000	0.991	0.991	0.992
		Constant	5.721	0.269	450.711	1.000	0.000	305.116		

Appendix 9 (continued)

Attrition to the 3rd Semester Variables Entering the Logistic Regression Model by Sex and Disability

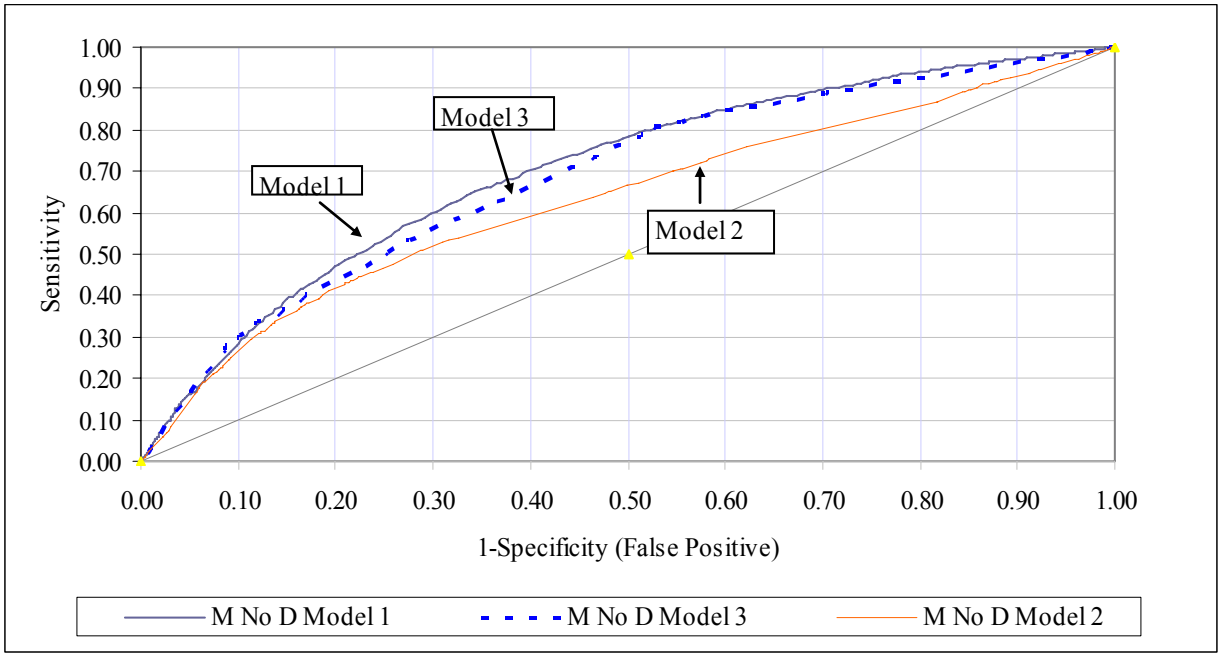
			B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
									Lower	Upper
With Disabilities	F	Comm S DipType			3.681	2.000	0.159			
		Comm_S_DipType(1)	-1.191	0.621	3.671	1.000	0.055	0.304	0.090	1.028
		Comm_S_DipType(2)	-0.024	0.577	0.002	1.000	0.966	0.976	0.315	3.023
	N = 473	LANGUAGE			0.220	2.000	0.896			
		LANGUAGE(1)	-0.181	0.501	0.131	1.000	0.717	0.834	0.312	2.227
		LANGUAGE(2)	-0.328	0.725	0.205	1.000	0.651	0.720	0.174	2.983
		Age01(1)	-0.299	0.342	0.764	1.000	0.382	0.742	0.380	1.449
		EngPlace01(1)	-0.521	0.318	2.687	1.000	0.101	0.594	0.319	1.107
		MedianFamInc01(1)	-0.588	0.315	3.500	1.000	0.061	0.555	0.300	1.028
		COB01(1)	0.597	0.647	0.852	1.000	0.356	1.817	0.511	6.453
		High School Average	-0.005	0.003	3.967	1.000	0.046	0.995	0.990	1.000
		Constant	2.307	2.088	1.221	1.000	0.269	10.048		
	M	Comm S DipType			4.857	2.000	0.088			
		Comm_S_DipType(1)	-1.466	0.747	3.849	1.000	0.050	0.231	0.053	0.999
	N = 415	Comm_S_DipType(2)	-0.625	0.560	1.246	1.000	0.264	0.535	0.178	1.604
		LANGUAGE			0.245	2.000	0.885			
		LANGUAGE(1)	-0.226	0.673	0.113	1.000	0.737	0.798	0.213	2.982
		LANGUAGE(2)	-0.432	0.875	0.244	1.000	0.622	0.649	0.117	3.608
		Age01(1)	-0.669	0.300	4.954	1.000	0.026	0.512	0.284	0.923
		EngPlace01(1)	0.029	0.293	0.010	1.000	0.920	1.030	0.580	1.827
		MedianFamInc01(1)	0.004	0.300	0.000	1.000	0.990	1.004	0.558	1.806
		COB01(1)	-0.144	0.556	0.067	1.000	0.796	0.866	0.291	2.577
		High School Average	-0.004	0.002	2.513	1.000	0.113	0.996	0.991	1.001
		Constant	2.011	1.999	1.012	1.000	0.314	7.471		

Appendix 10

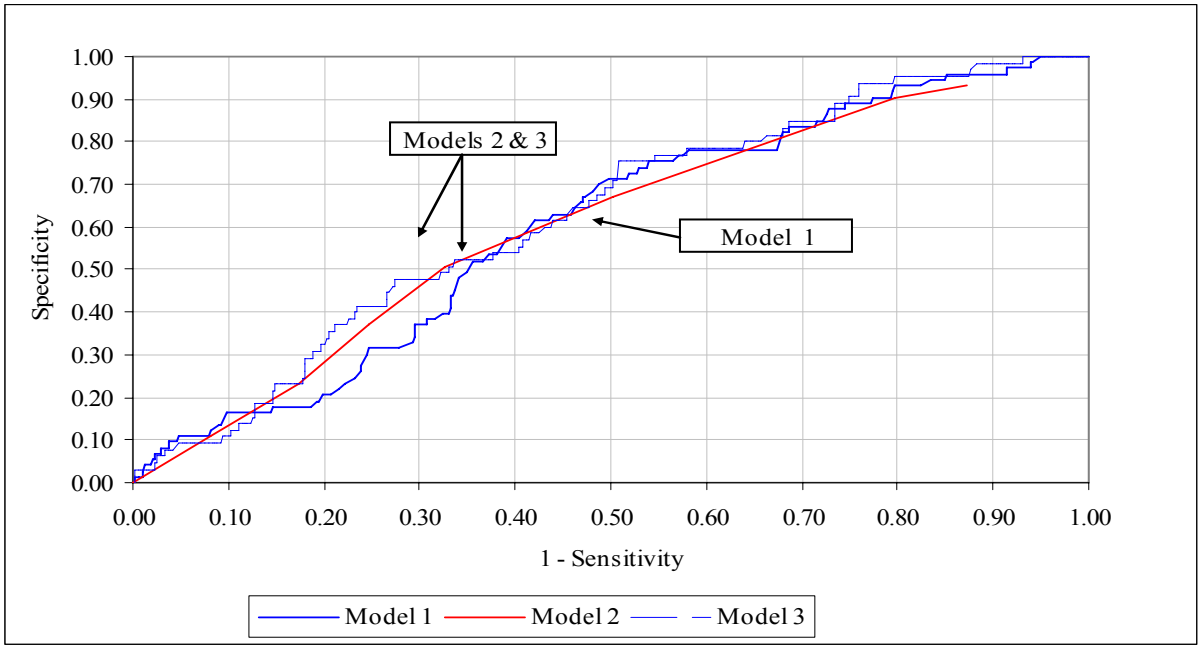
Three Models of Third Semester Attrition by Sex and Disability

		Sex	Area	SE	Sig	Asympt Lower	Upper	Attritio	N
Model 1	No	F	0.670	0.005	0.000	0.661	0.680	19.5%	18323
HS Avg		M	0.703	0.005	0.000	0.693	0.712	25.0%	14066
	With	F	0.579	0.036	0.048	0.508	0.650	11.6%	509
		M	0.602	0.033	0.006	0.536	0.668	16.3%	449
Model 2	No	F	0.628	0.005	0.000	0.618	0.638	20.1%	19560
6 Records		M	0.631	0.006	0.000	0.620	0.642	25.2%	14796
	With	F	0.671	0.038	0.000	0.597	0.745	12.2%	510
		M	0.634	0.034	0.000	0.567	0.701	16.0%	457
Model 3	No	F	0.689	0.005	0.000	0.678	0.699	18.9%	17244
Rec+HS		M	0.712	0.005	0.000	0.701	0.722	23.9%	12976

Males Without Disabilities



Appendix 10 (continued) Males With Disabilities



Appendix 11

Variables Signficant for Career and Pre-University - Sector 10th Semester attrition

	Variables not in Equation				Variables in Equation	B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
		Score	df	Sig.								Lower	Upper
Preu	French	39.424	2	0.000	LANGUAGE			86.735	2	0.000			
	English	7.622	1	0.006	LANGUAGE(1)	-0.409	0.053	59.879	1	0.000	0.664	0.599	0.737
	Other Language	3.812	1	0.051	LANGUAGE(2)	-0.567	0.063	81.103	1	0.000	0.567	0.501	0.642
	Age01(1)	883.408	1	0.000	Age01(1)	-0.554	0.047	141.613	1	0.000	0.575	0.525	0.630
	EngPlace01(1)	114.850	1	0.000	EngPlace01(1)	0.039	0.041	0.901	1	0.342	1.040	0.959	1.128
	MedianFamInc01(1)	146.776	1	0.000	MedianFamInc01(1)	-0.238	0.037	42.257	1	0.000	0.788	0.734	0.847
	COB01(1)	1.228	1	0.268	COB01(1)	-0.027	0.061	0.198	1	0.657	0.973	0.863	1.097
	Sex01(1)	222.200	1	0.000	Sex01(1)	-0.274	0.036	58.347	1	0.000	0.760	0.708	0.816
	High School	2415.542	1	0.000	High School	-0.011	0.000	1483.847	1	0.000	0.989	0.989	0.990
		2753.559	8	0.000	Constant	8.678	0.220	1549.668	1	0.000	5869.357		
Careers	LANGUAGE	11.749	2	0.003	LANGUAGE			17.059	2	0.000			
	LANGUAGE(1)	6.082	1	0.014	LANGUAGE(1)	-0.200	0.107	3.481	1	0.062	0.818	0.663	1.010
	LANGUAGE(2)	11.740	1	0.001	LANGUAGE(2)	-0.490	0.122	16.092	1	0.000	0.612	0.482	0.778
	Age01(1)	53.399	1	0.000	Age01(1)	-0.189	0.092	4.225	1	0.040	0.828	0.692	0.991
	EngPlace01(1)	6.003	1	0.014	EngPlace01(1)	-0.010	0.081	0.014	1	0.905	0.990	0.844	1.162
	MedianFamInc01(1)	0.471	1	0.493	MedianFamInc01(1)	-0.022	0.080	0.072	1	0.788	0.979	0.836	1.145
	COB01(1)	0.340	1	0.560	COB01(1)	-0.095	0.120	0.623	1	0.430	0.910	0.719	1.151
	Sex01(1)	37.605	1	0.000	Sex01(1)	-0.297	0.076	15.440	1	0.000	0.743	0.641	0.862
	High School	310.484	1	0.000	High School	-0.011	0.001	228.144	1	0.000	0.989	0.988	0.991
		345.571	8	0.000	Constant	8.34	0.55	232.414	1	0.000	4196.989		

Area Under the Curve(c.d)
Test Result Variable(s): Predicted probability

	Area	SE	Sig	Asymptotic 95% Confidence Lower	Upper Bound
Preu	0.746	0.004	0.000	0.738	0.753
Careers	0.693	0.009	0.000	0.675	0.711

Appendix 12

All Students with Disabilities – Differences in Third Semester Attrition Rate by Level of Variable

Difference is Between the Highest and Lowest Values of the Binary Variables.

Statistically significant differences are highlighted in bold.

Variables	N	Attrition	Diff	% in Category	ChiSq	df	Sig
Expected Hours of Paid Employment - >15 hrs	49	27.3%	11.5%	22.4%	0.75	1	0.39
Motivation - Low or Average	149	15.4%	7.7%	8.7%	0.57	1	0.45
First Generation College Student - Yes	140	NA	NA	2.1%	NA	NA	NA
First Choice Program - Yes	148	7.1%	-8.5%	9.4%	0.73	1	0.35
Study time last year <=12 hrs	142	18.4%	15.9%	72.5%	5.9	1	0.02
Study cegep <=15 hrs	141	17.5%	10.7%	68.8%	2.85	1	0.09
*Age - 18 & Over	1096	21.0%	9.9%	36.0%	19.7	1	<.01
*Median Family Income <=$60000	1079	16.4%	3.4%	41.0%	2.4	1	0.12
*Country of Birth - Outside of Canada	1096	15.9%	1.3%	8.0%	0.11	1	0.74
*High School Average <75	958	16.7%	8.6%	63.7%	12.24	1	<.01
*English Placement Level - Low	984	16.6%	3.9%	39.1%	2.98	1	0.08
Degree Aspirations DEC or Bachelor's	104	21.9%	8.0%	30.8%	1.03	1	0.31
*Language - French	1096	14.9%	2.5%	6.8%	0.02	2	0.99
*Diploma Type - Technical	1096	15.6%	-7.3%	9.1%	4.86	2	0.09
Place of Birth Mother - Canada	146	16.7%	6.0%	61.6%	0.99	1	0.32
Place of Birth Father - Canada	145	15.1%	1.6%	59.3%	0.07	1	0.79

* Variables are from students' records and, therefore, have higher N values.

Appendix 13
Students Without Disabilities - t-tests and Differences in CRC Scores by Level of Variable
Select CRC>1 and SecV>100

Sex	Variable	Level	N	Mean	SD	SE	t or F	df	Sig	Diff
F	Age	Over17	1708	22.29	5.86	0.14	-20.30	10730.00	0.00	-2.90
		17&Under	9024	25.19	5.33	0.06				
M	Age	Over17	1543	20.28	6.08	0.15	-19.38	7672.00	0.00	-3.24
		17&Under	6131	23.51	5.80	0.07				
F	HS Grade	Under75	3885	20.98	4.89	0.08	-61.05	7731.08	0.00	-5.89
		75 Or Over	6840	26.87	4.64	0.06				
M	HS Grade	Under75	3853	19.72	5.15	0.08	-54.51	7656.38	0.00	-6.34
		75 Or Over	3806	26.06	5.04	0.08				
F	Eng Placement Level	EngPlaceLow	3926	23.47	5.21	0.08	-19.14	8603.40	0.00	-2.05
		EngPlaceHigh	6711	25.52	5.52	0.07				
M	Eng Placement Level	EngPlaceLow	2924	21.38	5.54	0.10	-18.35	6621.57	0.00	-2.49
		EngPlaceHigh	4663	23.87	6.06	0.09				
F	Program Choice	2nd or Higher	264	23.19	4.78	0.29	-9.89	2356.00	0.00	-3.18
		First Choice	2094	26.37	4.94	0.11				
M	Program Choice	2nd or Higher	253	21.67	5.50	0.35	-8.81	1511.00	0.00	-3.41
		First Choice	1260	25.08	5.64	0.16				
F	Paid Employment	<=15	1589	26.34	4.96	0.12	7.40	1957.00	0.00	2.13
		>15	370	24.21	5.10	0.27				
M	Paid Employment	<=15	983	25.07	5.53	0.18	8.17	1260.00	0.00	3.09
		>15	279	21.99	5.69	0.34				
F	Diploma Type	Pre-university	8424	25.01	5.60	0.06	10.36	2279.11	0.00	1.47
		Careers	1530	23.54	5.01	0.13				
M	Diploma Type	Pre-university	5613	23.11	6.20	0.08	4.94	2386.17	0.00	0.83
		Careers	1395	22.29	5.42	0.15				
F	Level of Studies	DEC or Bach	483	25.33	4.73	0.22	-4.89	1571.00	0.00	-1.32
		Masters or PhD	1090	26.66	5.04	0.15				
M	Level of Studies	DEC or Bach	310	23.31	5.90	0.34	-5.42	945.00	0.00	-2.15
		Masters or PhD	637	25.46	5.63	0.22				
F	Motivation	Average or Lower	179	23.83	5.08	0.38	-6.13	2358.00	0.00	-2.38
		High or Very high	2181	26.20	4.98	0.11				
M	Motivation	Average or Lower	157	22.54	5.62	0.45	-4.57	1512.00	0.00	-2.20
		High or Very high	1357	24.75	5.74	0.16				
F	Study Time Last Year	<=12	1602	25.36	4.96	0.12	-10.88	2263.00	0.00	-2.45
		>12	663	27.81	4.66	0.18				
M	Study Time Last Year	<=12	1231	24.18	5.68	0.16	-5.99	1460.00	0.00	-2.45
		>12	231	26.62	5.77	0.38				

Appendix 13 (continued)

Students Without Disabilities - t-tests and Differences in CRC Scores by Level of Variable

Sex	Variable	Level	N	Mean	SD	SE	t or F	df	Sig	Diff
F	Median Family Income (PC)	<=60000	5762	24.10	5.64	0.07	-12.97	10600.93	0.00	-1.37
		>60000	4928	25.47	5.28	0.08				
M	Median Family Income (PC)	<=60000	4005	22.24	5.93	0.09	-9.46	7641.00	0.00	-1.29
		>60000	3638	23.54	6.01	0.10				
F	Country of Birth Mother	Other country	963	25.83	5.05	0.16	-1.44	2394.00	0.15	-0.30
		Canada	1433	26.13	4.99	0.13				
M	Country of Birth Mother	Other country	699	24.61	5.58	0.21	0.55	1579.00	0.58	0.16
		Canada	882	24.45	5.79	0.20				
F	Country of Birth Father	Other Country	1081	25.80	5.09	0.15	-1.87	2375.00	0.06	-0.39
		Canada	1296	26.19	4.93	0.14				
M	Country of Birth Father	Other Country	780	24.40	5.74	0.21	-0.66	1576.00	0.51	-0.19
		Canada	798	24.59	5.67	0.20				
F	First Generation Student	Not First Generation	1939	26.30	5.01	0.11	4.29	449.47	0.00	1.20
		First Generation	317	25.10	4.57	0.26				
M	First Generation Student	Not First Generation	1271	24.80	5.71	0.16	3.46	1453.00	0.00	1.55
		First Generation	184	23.25	5.59	0.41				
F	Country of Birth	Born outside Canada	1442	24.59	5.67	0.15	-1.03	10730.00	0.30	-0.16
		Born in Canada	9290	24.75	5.49	0.06				
M	Country of Birth	Born outside Canada	1184	22.83	5.99	0.17	-0.21	7672.00	0.83	-0.04
		Born in Canada	6490	22.87	6.00	0.07				
F	College Study Time	15 or fewer	1477	25.65	5.02	0.13	-4.92	2225.00	0.00	-1.11
		Over 15 hr	750	26.76	5.06	0.18				
M	College Study Time	15 or fewer	1077	24.21	5.72	0.17	-3.78	1434.00	0.00	-1.31
		Over 15 hr	359	25.52	5.62	0.30				
F	Language	French	1722	24.60	5.55	0.13	2.31	2, 10729	0.10	
		English	6611	24.82	5.58	0.07				
		Other Lang	2399	24.57	5.32	0.11				
M	Language	French	923	22.83	5.89	0.19	2.32	2, 7671	0.10	
		English	4940	22.96	6.03	0.09				
		Other Lang	1811	22.61	5.97	0.14				

Appendix 14

Students With Disabilities - t-tests and Differences in CRC Scores by Level of Variable

Sex	Variable	Level	N	Mean	SD	SE	t or	df	Sig	Diff
F	Age	Over17	77	22.92	4.37	0.50	1.55	340	0.12	-1.03
		17&Under	265	23.95	5.33	0.33				
M	Age	Over17	79	19.44	5.17	0.58	3.35	309	0.00	-2.38
		17&Under	232	21.82	5.56	0.37				
F	HS Grade	Under75	180	21.41	4.36	0.32	9.93	340	0.00	-4.87
		75 Or Over	162	26.28	4.72	0.37				
M	HS Grade	Under75	211	19.36	4.78	0.33	9.63	186.24	0.00	-5.78
		75 Or Over	100	25.14	5.02	0.50				
F	Eng Placement Level	EngPlaceLow	148	22.39	4.58	0.38	4.21	336	0.00	-2.33
		EngPlaceHigh	190	24.72	5.37	0.39				
M	Eng Placement Level	EngPlaceLow	133	20.36	5.16	0.45	2.67	301	0.01	-1.69
		EngPlaceHigh	170	22.04	5.71	0.44				
F	Choice	2nd or Higher	5	24.04	4.28	1.91	0.36	59.00	0.72	-0.89
		First Choice	56	24.93	5.30	0.71				
M	Choice	2nd or Higher	8	20.54	3.93	1.39	1.89	73.00	0.06	-3.56
		First Choice	67	24.10	5.15	0.63				
F	Paid Employment	<=15	43	25.07	5.42	0.83	0.98	46	0.33	-2.44
		>15	5	27.50	2.82	1.26				
M	Paid Employment	<=15	57	23.70	5.40	0.71	0.63	59	0.53	1.72
		>15	4	21.98	2.76	1.38				
F	Diploma Type	Pre-university	276	23.82	5.29	0.32	1.12	83.84	0.27	0.70
		Careers	48	23.13	3.73	0.54				
M	Diploma Type	Pre-university	256	21.09	5.49	0.34	0.93	284	0.35	-1.01
		Careers	30	22.09	6.38	1.16				
F	Level of Studies	DEC or Bach	13	23.76	5.52	1.53	0.91	38	0.37	-1.80
		Masters or PhD	27	25.56	6.03	1.16				
M	Level of Studies	DEC or Bach	16	23.17	4.50	1.13	0.54	54	0.59	-0.82
		Masters or PhD	40	23.99	5.44	0.86				
F	Motivation	Average or Lower	4	25.73	3.73	1.86	0.32	58	0.75	0.88
		High or Very high	56	24.85	5.34	0.71				
M	Motivation	Average or Lower	9	24.33	2.85	0.95	0.71	16.75	0.48	0.82
		High or Very high	68	23.51	5.35	0.65				
F	Study Time Last Year	<=12	35	23.91	4.35	0.73	1.62	57	0.11	-2.22
		>12	24	26.13	6.15	1.25				
M	Out of Class Study	<=12	59	22.97	4.91	0.64	2.44	70	0.02	-3.71
		>12	13	26.68	5.20	1.44				

Appendix 14 (continued)
Students With Disabilities - t-tests and Differences in CRC Scores by Level of Variable

Sex	Variable	Level	N	Mean	SD	SE	t or F	df	Sig	Diff
F	Income	<=60000	127	23.83	5.23	0.46	0.35	338	0.72	0.20
		>60000	213	23.62	5.12	0.35				
M	Income	<=60000	100	21.61	5.33	0.53	0.83	308	0.41	0.56
		>60000	210	21.05	5.67	0.39				
F	Country of Birth Mother	Other country	18	24.47	5.35	1.26	0.59	55	0.56	-0.89
		Canada	39	25.35	5.25	0.84				
M	Country of Birth Mother	Other country	32	25.10	5.21	0.92	2.22	75	0.03	2.56
		Canada	45	22.54	4.83	0.72				
F	Country of Birth Father	Other Country	24	25.62	4.69	0.96	0.67	55	0.50	0.95
		Canada	33	24.67	5.67	0.99				
M	Country of Birth Father	Other Country	29	24.97	5.08	0.94	1.85	75	0.07	2.20
		Canada	48	22.77	5.01	0.72				
F	First Generation Student	Not First Generation	57	24.85	5.34	0.71	0.29	57	0.77	-1.10
		First Generation	2	25.95	2.83	2.00	na	na	na	na
M	First Generation Student	Not First Generation	72	23.77	5.16	0.61	na	na	na	na
		First Generation	1	19.01	na	na	na	na	na	na
F	Country of Birth	Born outside Canada	31	24.49	4.50	0.81	0.88	340	0.38	0.86
		Born in Canada	311	23.64	5.20	0.29				
M	Country of Birth	Born outside Canada	22	20.75	5.43	1.16	0.41	309	0.68	-0.51
		Born in Canada	289	21.25	5.57	0.33				
F	College Study Time	15 or fewer	38	24.60	5.30	0.86	0.42	55	0.68	-0.63
		Over 15 hr	19	25.23	5.52	1.27				
M	College Study Time	15 or fewer	50	22.60	4.55	0.64	2.31	71	0.02	-2.94
		Over 15 hr	23	25.54	6.02	1.26				
F	Language	French	25	24.13	5.08	1.02	0.72	2, 339	0.49	
		English	287	23.58	5.24	0.31				
		Other Lang	30	24.69	4.18	0.76				
M	Language	French	15	23.72	4.91	1.27	2.23	2, 308	0.11	
		English	278	21.00	5.48	0.33				
		Other Lang	18	22.49	6.75	1.59				

Appendix 15

Model 2 Academic Achievement First Semester - Six Records Variables by Sex and Disability (CRC <25, >= 25)

Variables not in the Equation					**Variables in the Equation**						C.I.for EXP(B)		
Group	Variable	Score	df	Sig.		B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
F	Diploma Type PreU	95.86	2	0.000	Diploma Type PreU			41.320	2	0.000			
Without	Diploma Type Tech	82.65	1	0.000	Diploma Type Tech	0.377	0.059	41.032	1	0.000	1.457	1.299	1.635
Disabilities	Diploma Type A&T	6.62	1	0.010	Diploma Type A&T	0.102	0.078	1.702	1	0.192	1.107	0.950	1.291
	French	6.32	2	0.042	French			16.266	2	0.000			
	English	4.47	1	0.034	English	0.205	0.058	12.626	1	0.000	1.227	1.096	1.374
	Other Language	5.92	1	0.015	Other Language	0.047	0.071	0.449	1	0.503	1.049	0.913	1.205
	Age	228.96	1	0.000	Age	-0.683	0.060	128.360	1	0.000	0.505	0.449	0.568
	MedianFamily	131.03	1	0.000	MedianFamily	-0.362	0.041	78.115	1	0.000	0.696	0.642	0.754
	English Placement	361.91	1	0.000	English Placement	-0.717	0.044	261.615	1	0.000	0.488	0.447	0.532
	Country of Birth	1.07	1	0.301	Country of Birth	0.335	0.070	22.704	1	0.000	1.398	1.218	1.605
	Overall Statistics	654.32	8	0.000	Constant	0.594	0.091	42.222	1	0.000	1.812		
M	Diploma Type PreU	48.96	2	0.000	Diploma Type PreU			22.738	2	0.000			
Without	Diploma Type Tech	13.76	1	0.000	Diploma Type Tech	0.109	0.066	2.749	1	0.097	1.115	0.980	1.269
Disabilities	Diploma Type A&T	28.46	1	0.000	Diploma Type A&T	0.432	0.093	21.660	1	0.000	1.541	1.284	1.848
	French	2.12	2	0.346	French			7.457	2	0.024			
	English	1.65	1	0.199	English	0.177	0.077	5.244	1	0.022	1.194	1.026	1.390
	Other Language	2.00	1	0.157	Other Language	0.042	0.093	0.202	1	0.653	1.043	0.869	1.250
	Age	184.19	1	0.000	Age	-0.787	0.071	121.846	1	0.000	0.455	0.396	0.524
	MedianFamily	86.62	1	0.000	MedianFamily	-0.354	0.050	50.267	1	0.000	0.702	0.637	0.774
	English Placement	278.47	1	0.000	English Placement	-0.740	0.054	185.629	1	0.000	0.477	0.429	0.531
	Country of Birth	0.11	1	0.739	Country of Birth	0.406	0.082	24.694	1	0.000	1.501	1.279	1.761
	Overall Statistics	490.24	8	0.000	Constant	1.205	0.115	109.663	1	0.000	3.336		

Appendix 15 (continued)

Model 2 Academic Achievement First Semester - Six Records Variables by Sex and Disability (CRC <25, >= 25)

Variables not in the Equation				
Group	Variable	Score	df	Sig.
Females With Disabilities	Diploma Type PreU	4.18	2	0.124
	Diploma Type Tech	3.94	1	0.047
	Diploma Type A&T	0.47	1	0.495
	French	1.28	2	0.527
	English	1.26	1	0.262
	Other Language	0.81	1	0.369
	Age	2.95	1	0.086
	MedianFamily Income(PC)	0.53	1	0.469
	English Placement Level	15.24	1	0.000
	Country of Birth	0.53	1	0.469
	Overall Statistics	23.24	8	0.003
Males With Disabilities	Diploma Type PreU	0.61	2	0.739
	Diploma Type Tech	0.57	1	0.449
	Diploma Type A&T	0.07	1	0.798
	French	6.77	2	0.034
	English	5.07	1	0.024
	Other Language	0.51	1	0.475
	Age	6.13	1	0.013
	MedianFamily Income(PC)	0.00	1	0.966
	English Placement Level	9.67	1	0.002
	Country of Birth	0.59	1	0.442
	Overall Statistics	25.33	8	0.001

Variables in the Equation							C.I.for EXP(B)	
Variable	B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Diploma Type PreU			2.559	2	0.278			
Diploma Type Tech	0.555	0.355	2.437	1	0.118	1.742	0.868	3.496
Diploma Type A&T	-0.107	0.499	0.046	1	0.830	0.898	0.338	2.387
French			2.689	2	0.261			
English	0.409	0.440	0.862	1	0.353	1.505	0.635	3.565
Other Language	-0.219	0.582	0.141	1	0.707	0.804	0.257	2.514
Age	-0.411	0.293	1.972	1	0.160	0.663	0.373	1.177
MedianFamily Income(PC)	0.160	0.247	0.416	1	0.519	1.173	0.722	1.905
English Placement Level	-0.893	0.241	13.716	1	0.000	0.410	0.255	0.657
Country of Birth	0.252	0.416	0.368	1	0.544	1.287	0.570	2.906
Constant	0.434	0.612	0.501	1	0.479	1.543		
Diploma Type PreU			1.067	2	0.586			
Diploma Type Tech	-0.473	0.464	1.040	1	0.308	0.623	0.251	1.547
Diploma Type A&T	0.022	0.524	0.002	1	0.966	1.022	0.366	2.856
French			9.756	2	0.008			
English	1.700	0.587	8.395	1	0.004	5.476	1.734	17.296
Other Language	0.793	0.797	0.992	1	0.319	2.211	0.464	10.538
Age	-0.782	0.374	4.358	1	0.037	0.458	0.220	0.953
MedianFamily Income(PC)	0.074	0.306	0.059	1	0.808	1.077	0.591	1.963
English Placement Level	-0.949	0.304	9.730	1	0.002	0.387	0.213	0.703
Country of Birth	-0.752	0.654	1.321	1	0.250	0.472	0.131	1.699
Constant	1.402	0.890	2.485	1	0.115	4.064		

Appendix 16

Model 3 Academic Achievement First Semester- Six Records Variables & High School Average by Sex and Disability (CRC<25;

Variables not in the Equation					**Variables in the Equation**								
Group	Variable	Score	df	Sig.	Variable	B	S.E.	Wald	df	Sig.	Exp(B)	C.I.for EXP(B) Lower	Upper
	Diploma Type PreU	95.86	2	0.000	Diploma Type PreU			26.244	2	0.000			
	Diploma Type Tech	82.65	1	0.000	Diploma Type Tech	0.281	0.068	17.114	1	0.000	1.324	1.159	1.513
	Diploma Type A&T	6.62	1	0.010	Diploma Type A&T	-0.212	0.087	5.913	1	0.015	0.809	0.682	0.960
	French	6.32	2	0.042	French			14.880	2	0.001			
	English	4.47	1	0.034	English	-0.263	0.068	14.824	1	0.000	0.768	0.672	0.879
Females	Other Language	5.92	1	0.015	Other Language	-0.183	0.084	4.816	1	0.028	0.832	0.707	0.981
Without	Age	228.96	1	0.000	Age	0.073	0.073	0.989	1	0.320	1.076	0.932	1.242
Disabilities	English Placement Level	361.91	1	0.000	English Placement Level	-0.131	0.053	6.178	1	0.013	0.877	0.790	0.973
	Median Family Income(PC)	131.03	1	0.000	Median Family Income(PC)	-0.278	0.049	32.758	1	0.000	0.758	0.689	0.833
	Country of Birth	1.07	1	0.301	Country of Birth	-0.043	0.083	0.269	1	0.604	0.958	0.814	1.127
	High School Average	3241.81	1	0.000	High School Average	-0.024	0.001	2129	1	0.000	0.976	0.975	0.977
	Overall	3316.11	9	0.000	Constant	19.196	0.421	2083	1	0.000	21705362		
	Diploma Type PreU	48.96	2	0.000	Diploma Type PreU			3.697	2	0.157			
	Diploma Type Tech	13.76	1	0.000	Diploma Type Tech	-0.140	0.076	3.434	1	0.064	0.869	0.749	1.008
	Diploma Type A&T	28.46	1	0.000	Diploma Type A&T	0.021	0.102	0.041	1	0.840	1.021	0.835	1.248
	French	2.12	2	0.346	French			5.191	2	0.075			
	English	1.65	1	0.199	English	-0.209	0.092	5.186	1	0.023	0.811	0.677	0.971
Males	Other Language	2.00	1	0.157	Other Language	-0.174	0.110	2.509	1	0.113	0.840	0.677	1.042
Without	Age	184.19	1	0.000	Age	-0.012	0.086	0.018	1	0.893	0.988	0.835	1.171
Disabilities	English Placement Level	278.47	1	0.000	English Placement Level	-0.076	0.065	1.365	1	0.243	0.927	0.816	1.053
	Median Family Income(PC)	86.62	1	0.000	Median Family Income(PC)	-0.322	0.059	29.496	1	0.000	0.725	0.645	0.814
	Country of Birth	0.11	1	0.739	Country of Birth	0.055	0.097	0.320	1	0.572	1.056	0.874	1.277
	High School Average	2301.15	1	0.000	High School Average	-0.024	0.001	1474	1	0.000	0.976	0.975	0.977
	Overall	2336.26	9	0.000	Constant	19.064	0.491	1507	1	0.000	19026729		

Appendix 16 (continued)
Model 3 Academic Achievement First Semester- Six Records Variables & High School Average by Sex and Disability (CRC<25; CRC>25)

Variables not in the Equation				
Group	Variable	Score	df	Sig.
Females With Disabilities	Diploma Type PreU	4.178	2	0.124
	Diploma Type Tech	3.936	1	0.047
	Diploma Type A&T	0.467	1	0.495
	French	1.279	2	0.527
	English	1.257	1	0.262
	Other Language	0.808	1	0.369
	Age	2.955	1	0.086
	Enlglish Placement	15.239	1	0.000
	Median Family	0.525	1	0.469
	Country of Birth	0.525	1	0.469
	High School Average	96.488	1	0.000
	Overall Statistics	100.000	9	0.000
Males With Disabilties	Diploma Type PreU	0.606	2	0.739
	Diploma Type Tech	0.572	1	0.449
	Diploma Type A&T	0.066	1	0.798
	French	6.769	2	0.034
	English	5.074	1	0.024
	Other Language	0.510	1	0.475
	Age	6.130	1	0.013
	English Placement	9.671	1	0.002
	Median Family	0.002	1	0.966
	Country of Birth	0.591	1	0.442
	High School Average	85.579	1	0.000
	Overall Statistics	89.903	9	0.000

Variables in the Equation								
Variable	B	S.E.	Wald	df	Sig.	Exp(B)	C.I.for Lower	Upper
Diploma Type PreU			1.149	2	0.563			
Diploma Type Tech	0.257	0.387	0.440	1	0.507	1.293	0.605	2.763
Diploma Type A&T	-0.455	0.580	0.616	1	0.432	0.634	0.204	1.976
French			1.029	2	0.598			
English	0.296	0.492	0.362	1	0.547	1.344	0.513	3.523
Other Language	-0.132	0.650	0.041	1	0.839	0.876	0.245	3.132
Age	0.045	0.343	0.017	1	0.895	1.046	0.534	2.050
English Placement	-0.193	0.285	0.459	1	0.498	0.824	0.471	1.442
Median Family	0.018	0.290	0.004	1	0.952	1.018	0.576	1.798
Country of Birth	0.205	0.485	0.178	1	0.673	1.227	0.474	3.175
High School Average	-0.024	0.003	60.112	1	0.000	0.976	0.970	0.982
Constant	18.271	2.422	56.925	1	0.000	86094286		
Diploma Type PreU			0.187	2	0.911			
Diploma Type Tech	-0.237	0.552	0.184	1	0.668	0.789	0.267	2.329
Diploma Type A&T	0.000	0.568	0.000	1	1.000	1.000	0.328	3.047
French			2.690	2	0.261			
English	1.026	0.650	2.489	1	0.115	2.790	0.780	9.982
Other Language	0.576	0.907	0.404	1	0.525	1.779	0.301	10.524
Age	-0.277	0.438	0.399	1	0.528	0.758	0.321	1.790
English Placement	-0.451	0.352	1.637	1	0.201	0.637	0.319	1.271
Median Family	-0.029	0.359	0.007	1	0.935	0.971	0.481	1.963
Country of Birth	-0.869	0.736	1.393	1	0.238	0.419	0.099	1.775
High School Average	-0.023	0.003	49.660	1	0.000	0.977	0.971	0.984
Constant	18.451	2.631	49.191	1	0.000	103059587		

Appendix 17
AUC's for Models of First Semester Academic Performance - Students With and Without Disabilities

Model Description	Group	Sex	Area	SE	Sig	Confidence Interval		N
						Lower	Upper	
Model 1	No Disabilities	F	0.831	0.004	0.000	0.824	0.839	10732
HS Average		M	0.834	0.005	0.000	0.825	0.843	7674
Model 2	No Disabilities	F	0.643	0.005	0.000	0.632	0.653	10596
6 Records Variables		M	0.653	0.006	0.000	0.641	0.666	7557
Model 3	No Disabilities	F	0.834	0.004	0.000	0.826	0.841	10596
HS Average & 6 Records		M	0.835	0.005	0.000	0.825	0.844	7557
Model 4	No Disabilities	F	0.646	0.017	0.000	0.613	0.678	1169
9 ISS Variables		M	0.685	0.020	0.000	0.647	0.724	724
Model 5	No Disabilities	F	0.819	0.012	0.000	0.795	0.843	1169
9 ISS & HS Average		M	0.850	0.014	0.000	0.823	0.877	724
Model 6	No Disabilities	F	0.680	0.016	0.000	0.648	0.712	1168
9ISS & 6 Records		M	0.732	0.019	0.000	0.695	0.768	721
Model 7	No Disabilities	F	0.826	0.012	0.000	0.802	0.850	1168
9ISS & 6 Records & HSAvg		M	0.851	0.014	0.000	0.825	0.878	721
Model 1	No Disabilities	M	0.834	0.005	0.000	0.825	0.843	7674
HS Average	With Disabilities	M	0.825	0.030	0.000	0.765	0.884	311
	No Disabilities	F	0.831	0.004	0.000	0.824	0.839	10732
	With Disabilities	F	0.823	0.023	0.000	0.778	0.868	342
Model 2	No Disabilities	M	0.653	0.006	0.000	0.641	0.666	7557
6 Records Variables	With Disabilities	M	0.694	0.033	0.000	0.628	0.759	302
	No Disabilities	F	0.643	0.005	0.000	0.632	0.653	10596
	With Disabilities	F	0.656	0.030	0.000	0.597	0.715	336
Model 3	No Disabilities	M	0.835	0.005	0.000	0.825	0.844	7557
HS Average & 6 Records	With Disabilities	M	0.830	0.029	0.000	0.772	0.887	302
	No Disabilities	F	0.834	0.004	0.000	0.826	0.841	10596
	With Disabilities	F	0.827	0.023	0.000	0.782	0.873	336

Appendix 18
Sample Description for Student Readiness Inventory Analysis

Third Semester Attrition Rates for SRI Sample by Sex and Disability
N = 434 Cohort A Students

Sex	Group		Retained	Dropout	Total
F	No Dis	No	238	30	268
		%	88.8	11.2	100
	With Dis	No	21	3	24
		%	87.5	12.5	100
	Total	No	259	33	292
		%	88.7	11.3	100
M	No Dis	No	116	13	129
		%	89.9	10.1	100
	With Dis	No	11	2	13
		%	84.6	15.4	100
	Total	No	127	15	142
		%	89.4	10.6	100
Total	No Dis	No	354	43	397
		%	89.2	10.8	100
	With Dis	No	32	5	37
		%	86.5	13.5	100
	Total	No	386	48	434
		%	88.9	11.1	100

Appendix 18 (continued)

Sample Description for Student Readiness Inventory Analysis

CRC Scores	N = 427 Cohort A Students						
			CRC >=25	<25	Total	M	SD
No Disabilities	F	No	191	74	265	27.09	4.72
		%	72.1	27.9	100		
	M	No	79	49	128	25.95	4.54
		%	61.7	38.3	100		
		No	270	123	393	26.72	4.69
	Total	%	68.7	31.3	100		
With Disabilities	F	No	12	10	22	24.53	6.02
		%	54.5	45.5	100		
	M	No	0	12	12	20.40	3.98
		%	0	100	100		
		No	12	22	34	23.1	5.69
	Total	%	35.3	64.7	100		
Grand Total	F	No	203	84	287	26.90	4.86
		%	70.7	29.3	100		
	M	No	79	61	140	25.47	4.75
		%	56.4	43.6	100		
	Total	No	282	145	427	26.43	4.87
		%	66.0	34.0	100		

Appendix 19

3rd Semester Logistic Regression Model Using Survey and Records Variables.

	Variables not in the Equation				Variables in the Equation							C.I.for EXP(B)	
Group	Variable	Score	df	Sig.	Variable	B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
F	Diploma Type PreU	0.667	2	0.717	Diploma Type PreU			1.407	2	0.495			
Without	Diploma Type Tech	0.004	1	0.950	Diploma Type Tech	-0.283	0.290	0.950	1	0.330	0.754	0.427	1.331
Disabilities	Diploma Type A&T	0.666	1	0.414	Diploma Type A&T	-0.277	0.376	0.544	1	0.461	0.758	0.363	1.584
	French	7.524	2	0.023	French			7.429	2	0.024			
	English	0.385	1	0.535	English	-0.478	0.224	4.568	1	0.033	0.620	0.400	0.961
	Other Language	2.639	1	0.104	Other Language	-0.781	0.312	6.279	1	0.012	0.458	0.249	0.844
	Age	18.226	1	0.000	Age	-0.779	0.243	10.259	1	0.001	0.459	0.285	0.739
	English Placement	5.294	1	0.021	English Placement	-0.147	0.197	0.558	1	0.455	0.863	0.586	1.270
	Median Family Income	0.264	1	0.608	Median Family Income	-0.022	0.183	0.014	1	0.904	0.978	0.683	1.400
	Country of Birth	0.021	1	0.884	Country of Birth	-0.124	0.310	0.161	1	0.689	0.883	0.481	1.621
	Country of Birth Mother	1.014	1	0.314	Country of Birth	0.111	0.235	0.221	1	0.638	1.117	0.705	1.770
	Country of Birth Father	3.291	1	0.070	Country of Birth Father	0.267	0.234	1.299	1	0.254	1.306	0.825	2.065
	Program Choice	4.698	1	0.030	Program Choice	-0.236	0.251	0.882	1	0.348	0.790	0.483	1.292
	Motivation	8.192	1	0.004	Motivation	-0.651	0.293	4.938	1	0.026	0.522	0.294	0.926
	First Generation College	2.137	1	0.144	First Generation	0.158	0.242	0.427	1	0.513	1.172	0.729	1.884
	Level of Studies	2.673	1	0.102	Level of Studies	0.055	0.199	0.077	1	0.782	1.057	0.715	1.562
	College Study Time	7.683	1	0.006	College Study Time	-0.282	0.215	1.728	1	0.189	0.754	0.495	1.149
	OutofClass01(1)	12.216	1	0.000	OutofClass01(1)	-0.346	0.245	1.985	1	0.159	0.708	0.437	1.145
	Paid Employment	7.324	1	0.007	Paid Employment	0.251	0.213	1.396	1	0.237	1.286	0.847	1.951
	High School Average	32.849	1	0.000	High School Average	-0.006	0.002	12.540	1	0.000	0.994	0.991	0.998
	Overall Statistics	75.773	18	0.000	Constant	4.476	1.230	13.242	1	0.000	87.909		

Appendix 19 (continued)

3rd Semester Logistic Regression Model Using Survey and Records Variables.

	Variables not in the Equation				Variables in the Equation							C.I.for EXP(B)	
Group	Variable	Score	df	Sig.	Variable	B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
M Without Disabilities	Diploma Type PreU	0.938	2	0.626	Diploma Type PreU			2.521	2	0.284			
	Diploma Type Tech	0.729	1	0.393	Diploma Type Tech	-0.516	0.329	2.463	1	0.117	0.597	0.313	1.137
	Diploma Type A&T	0.317	1	0.573	Diploma Type A&T	0.033	0.447	0.005	1	0.942	1.033	0.430	2.481
	French	3.440	2	0.179	French			0.237	2	0.888			
	English	2.019	1	0.155	English	-0.153	0.335	0.208	1	0.648	0.859	0.446	1.654
	Other Language	3.413	1	0.065	Other Language	-0.183	0.447	0.168	1	0.682	0.833	0.346	2.001
	Age	9.658	1	0.002	Age	-0.834	0.328	6.453	1	0.011	0.434	0.228	0.827
	English Placement	1.256	1	0.262	English Placement	0.611	0.275	4.939	1	0.026	1.842	1.075	3.156
	Median Family Income	1.969	1	0.161	Median Family Income	0.507	0.244	4.317	1	0.038	1.661	1.029	2.679
	Country of Birth	6.044	1	0.014	Country of Birth	0.946	0.474	3.984	1	0.046	2.576	1.017	6.523
	Country of Birth	2.585	1	0.108	Country of Birth	-0.276	0.287	0.921	1	0.337	0.759	0.432	1.333
	Country of Birth Father	8.242	1	0.004	Country of Birth Father	0.334	0.285	1.374	1	0.241	1.397	0.799	2.444
	Program Choice	0.410	1	0.522	Program Choice	0.277	0.313	0.784	1	0.376	1.319	0.714	2.437
	Motivation	2.548	1	0.110	Motivation	-0.594	0.412	2.083	1	0.149	0.552	0.246	1.237
	First Generation	0.000	1	0.992	First Generation	-0.691	0.378	3.344	1	0.067	0.501	0.239	1.051
	Level of Studies	19.739	1	0.000	Level of Studies	-1.073	0.256	17.634	1	0.000	0.342	0.207	0.564
	College Study Time	0.000	1	0.995	College Study Time	0.375	0.295	1.619	1	0.203	1.456	0.816	2.595
	OutofClass01(1)	0.730	1	0.393	OutofClass01(1)	-0.077	0.366	0.044	1	0.834	0.926	0.452	1.897
	Paid Employment	21.611	1	0.000	Paid Employment	0.843	0.251	11.264	1	0.001	2.324	1.420	3.804
	High School Average	27.578	1	0.000	High School Average	-0.008	0.002	14.971	1	0.000	0.992	0.989	0.996
	Overall Statistics	84.219	18	0.000	Constant	3.964	1.514	6.852	1	0.009	52.676		

Appendix 20

Correlation Between High School Average, First Semester CRC Score and Attrition by the Third and Tenth Semester.

Group	Variable		3rd Sem Attrition	HS Average	1st Sem CRC	10th Sem Attrition
Females No Disabilities	3rd Sem Attrition	Pearson	1.000	-0.238	-0.362	0.619
		Sig. (2-tailed)		0.000	0.000	0.000
		N	19406	15752	8936	19406
	HS Average	Pearson	-0.238	1.000	0.648	**-0.341**
		Sig. (2-tailed)	0.000		0.000	0.000
		N	15752	15752	8243	15752
	1st Sem CRC	Pearson	-0.362	0.648	1.000	-0.456
		Sig. (2-tailed)	0.000	0.000		0.000
		N	8936	8243	8936	8936
	10th Sem Attrition	Pearson	0.619	-0.341	-0.456	1.000
		Sig. (2-tailed)	0.000	0.000	0.000	
		N	19406	15752	8936	19406
Females With Disabilities	3rd Sem Attrition	Pearson	1.000	-0.081	-0.253	0.433
		Sig. (2-tailed)		0.089	0.000	0.000
		N	498	439	288	498
	HS Average	Pearson	-0.081	1.000	0.598	-0.219
		Sig. (2-tailed)	0.089		0.000	0.000
		N	439	439	276	439
	1st Sem CRC	Pearson	-0.253	0.598	1.000	-0.400
		Sig. (2-tailed)	0.000	0.000		0.000
		N	288	276	288	288
	10th Sem Attrition	Pearson	0.433	-0.219	-0.400	1.000
		Sig. (2-tailed)	0.000	0.000	0.000	
		N	498	439	288	498

Appendix 20 (continued)

Correlation Between High School Average, First Semester CRC Score and Attrition by the Third and Tenth Semester.

Group	Variable		3rd Sem Attrition	HS Average	1st Sem CRC	10th Sem Attrition
Males	3rd Sem Attrition	Pearson	1.000	-0.294	-0.430	0.578
No Disabilities		Sig. (2-tailed)		0.000	0.000	0.000
		N	15636	12384	6567	15636
	HS Average	Pearson	-0.294	1.000	0.635	**-0.391**
		Sig. (2-tailed)	0.000		0.000	0.000
		N	12384	12384	6052	12384
	1st Sem CRC	Pearson	-0.430	0.635	1.000	-0.492
		Sig. (2-tailed)	0.000	0.000		0.000
		N	6567	6052	6567	6567
	10th Sem Attrition	Pearson	0.578	-0.391	-0.492	1.000
		Sig. (2-tailed)	0.000	0.000	0.000	
		N	15636	12384	6567	15636
Males	3rd Sem Attrition	Pearson	1.000	-0.147	-0.443	0.427
With Disabilities		Sig. (2-tailed)		0.005	0.000	0.000
		N	436	364	243	436
	HS Average	Pearson	-0.147	1.000	0.463	-0.285
		Sig. (2-tailed)	0.005		0.000	0.000
		N	364	364	229	364
	1st Sem CRC	Pearson	-0.443	0.463	1.000	-0.498
		Sig. (2-tailed)	0.000	0.000		0.000
		N	243	229	243	243
	10th Sem Attrition	Pearson	0.427	-0.285	-0.498	1.000
		Sig. (2-tailed)	0.000	0.000	0.000	
		N	436	364	243	436

Appendix 21 English Placement Test Level Definitions

Placement Code	Course Number	Placement Level	Course Title	Description
Q	603-101-04	4 High	Introduction to College English	Students should be fluent in English and should have taken some or all of their schooling in English. After taking this course, students should be able to analyze and produce written and oral work at an advanced level.
A (0,1,2,3,4,9)*	603-206-84 603-926-84	0 Low	English Usage: Prose II Linguistics: English II	This 90 hour course is offered by Continuing Education two evenings a week and costs $180. Students who are Not Qualified for Day Courses may register for this Continuing Education course during their regular Registration, but they will be charged out-of-program course fees ($180).They will not be permitted to register in any of the regular Day English courses until they pass this course.
X (R,S)*		0 Low	Not Qualified for Credit Courses	This means that the student does not qualify for the basic Preparatory English course offered during the Day. Instead the student requires a lower level English Language course such as "English Usage: Prose II" 603-206-84 + 603-926-84 "Linguistics: English II."
V	603-001-03	1 Low	Preparation for College English I	This is a mise-à-niveau course which is designed for students whose English Language skills are not advanced enough for the Writing English section of Introduction to College English 101 (I.C.E). Students placed at this level will still have to take the four (4) required English courses.
W	603-002-03	1 Low	Preparation for College English II	Students whose placement is 603-001 Preparation for College English I may take this course. This course prepares students for college-level English (Writing English 603-101) and does not give credit towards graduation requirements.
U (5,7)*	603-101-04	2 Low	I.C.E Writing English	This course is designed for students whose first language is not English and who have been educated in English for less than five years. Students are introduced to the study of literature at the college level, with special emphasis on vocabulary building, correct sentence structure, grammar, idiom and critical thinking.
T (6)*	603-101-04	3 Low	I.C.E effective Reading/Writing	This course is designed for students who need to improve their reading and writing skills.
P		3 Low	Preparatory Arts	Preparatory Arts is a session d'acceuil program for first-year Social Science students. Candidates are selected by the Prep. Arts Committee from among applications who have low reading scores on the College's placement test (blow grade 10), but who show original or insightful thinking in their placement essays. Prep. Arts students are placed under a special program number (08165) by the Registrar's Office but revert to their Social Science program number afterwards.

Appendix 22 Male and Female Attrition Rates at Matched High School Averages *(Attrition is to Semester 10).*

Group	HS Avg Range	Group Average F	Group Average M	F Attrition Rate	M Attrition Rate	Diff (M - F)
1	60 - 65	63.0	63.0	66.7%	74.8%	-8.1%
2	>65 - 70	67.9	67.7	52.9%	63.5%	-10.6%
3	>70 - 75	72.6	72.5	39.4%	45.9%	-6.5%
4	>75 - 80	77.4	77.3	26.7%	30.2%	-3.5%
5	>80 - 85	82.3	82.3	18.5%	19.8%	-1.3%
6	>85 - 90	87.2	87.1	13.2%	14.0%	-0.8%
7	>90 - 95	91.7	91.8	7.7%	12.8%	-5.1%